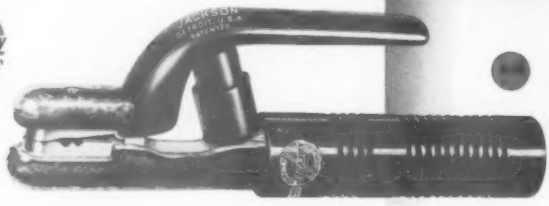
FEBRUARY, 1951

MAXIMUM CAPACITY AMPS	ROD SIZE	MODEL	* PRICE	DESCRIPTION	TONGS MADE OF	
300	1/4	A-1	5.50	INSULATED COPPER ALLOY MODELS	COPPER ALLOY HEAT TREATED FOR SUPERIOR STRENGTH HARDNESS CONDUCTIVITY	FULLY INSULATED
500	3/8	A-3	7.00			
500	3/8	A-3S	7.50			
300	1/4	AA-1	6.00	COPPER ALLOY MODELS WITH REPLACEABLE LOWER JAWS		
500	3/8	AA-3	7.50			
500	3/8	AA-3S	8.00			
300	1/4	TA-1	6.00	"QUIK-TRIK" DETACHABLE CABLE END		
500	3/8	TA-3	7.75			
300	1/4	A-W	6.60	"FEATHERLIGHT" MODELS	LIGHTWEIGHT ALLOY WITH REPLACEABLE COPPER ALLOY JAWS	
400	5/16	A-5S	7.75			
200	5/32	JH-2	5.50	"STREAMLINED" MODELS		
300	1/4	JH-3	6.60			
300	1/4	BT-3	6.00	BLADE-TYPE MODELS	STEEL BLADES INEXPENSIVE TO REPLACE	
500	3/8	BT-5	7.50			
300	1/4	B-1	3.25	ECONOMY MODELS	COPPER ALLOY	SEMI-INSULATED
500	3/8	B-3	4.00			
200	3/16	B-4	3.65		MALLORY 3 METAL	

* *All Prices Lower in Quantities*



To be sure . . .

We present them all . . . Jackson's complete line . . . light weight—heavy weight—200 amp to 500—tong and blade type. Take time to check this table against the various conditions of work in your shop . . . the light jobs—the heavy . . . the continuous as well as the occasional. Perhaps it will help you to get better, more economical results.

GROUND CLAMP

CABLE CONNECTOR

CABLE SPLICER

CABLE LUGS

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PRODUCTS
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The HOBART engine drive arc welder is "simplified", speedier . . . satisfying!

in...or out of the plant you'll find its exclusive

Remote* Control

- saves you money
- steps up production

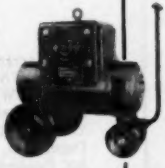
* Standard equipment with every Hobart.

200 AMP GAS DRIVE WELDER

Hobart gas drive welders are amply designed—are built to give you constant day in and day out service anywhere. You don't have to crowd a Hobart to do the job—it has what it takes to deliver the welding current required for your work. The choice of all who must have lowest welding costs, and longer life. Hobart welders are not skimped in any way.

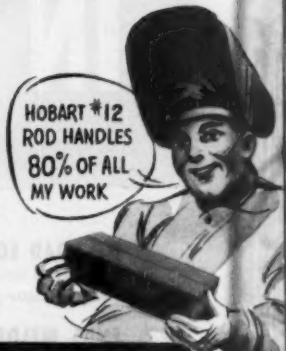
USE THE NEW HOBART ELECTRIC DRIVE...

There's a surprise ahead for you when you find how much easier it is to get quality welds faster. A size for every need.



It's smooth welding with HOBART NO. 12 ELECTRODES...

Hobart 12 is a premium electrode in QUALITY and PERFORMANCE—but at no premium in cost. It's an all purpose rod that gives more actual weld deposit, less clean up, and increased production. It's just one of a complete line. Use coupon for complete details.



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Remember this—no welder is better than the engineering and material that goes into it. Skimped, high speed welders cost you more in the long run—IT'S BETTER TO HAVE BOUGHT A HOBART THAN TO WISH FOR ONE LATER, especially if you are watching costs—need speedier production.

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- ☐ Electrode Catalog ☐ Information on _____ amp.

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NEW D-C WELDER
SAVES $126 A YEAR
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★ **NO-LOAD LOSS OF ONLY 500 WATTS...** compared to 2480-3600 watts on a conventional motor-generator welder.

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VOLUME 36 Number 2

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FEBRUARY, 1951

COVER: Argon metal-arc welding on an aluminum tank car being fabricated at General American Transportation Corp., Sharon, Pa. The machine is stationary while the work moves beneath it to make a continuous 33-ft longitudinal weld. Welds of X-ray quality are made at a speed of 15 ipm in aluminum of ½-in. thickness. Photo from The Linde Air Products Co.

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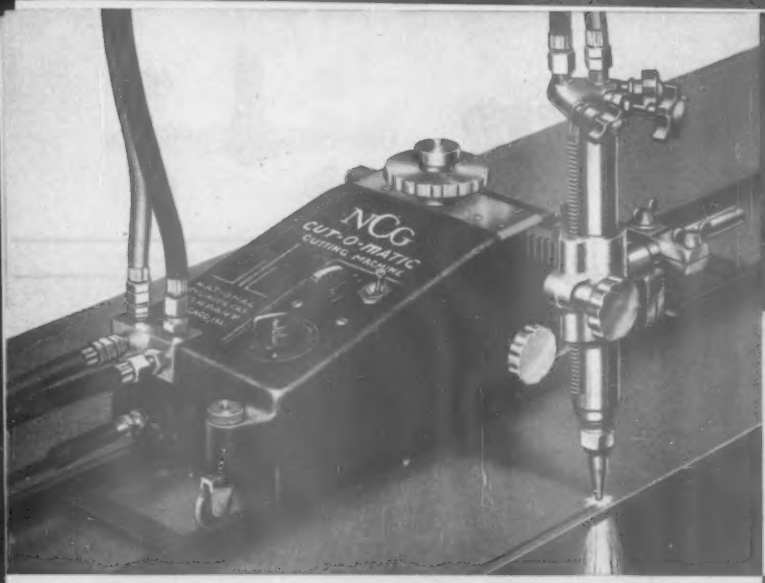
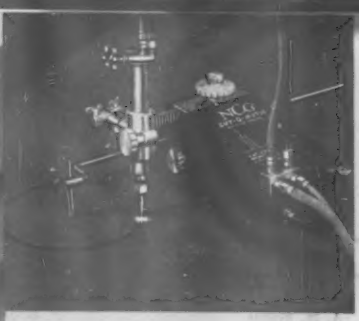




CIRCLES AND ARCS

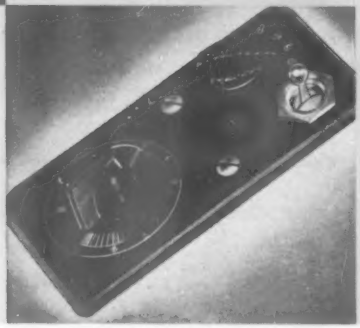
Circles or arcs, up to 60-in. in diameter, are cut by attaching radius rod assembly. Larger diameters may be cut with extension rod. Rings may be cut with double torch mounting.

SIMPLE CONTROLS

The Cut-O-Matic Control Panel is simple. A selector switch sets the travel at one of four speeds, and a rheostat permits accurate regulation anywhere between 4-in. and 60-in. per minute, in either direction.

CUT-O-MATIC

NCG'S PORTABLE, MOTOR-DRIVEN FLAME-CUTTING MACHINE



LOW-COST, VERSATILE, ACCURATE, FAST

Flame-Cutting with Substantial Savings in Labor and Materials

Here's a small, inexpensive cutting machine that's so efficient that grinding or machining of cuts are rarely necessary . . . That's so versatile you can cut light plate or heavy slabs—straight lines, bevels or various shapes . . . That's so portable you can take the machine to the job—inside or outside the shop, wherever power is available. And it has exclusive operating features that make it remarkably easy to handle.

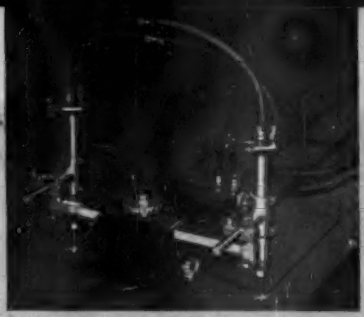
Yes, the NCG Cut-O-Matic is so efficient and so flexible in use that one man and a Cut-O-Matic make a hard-to-beat team to save time, labor, and materials.

The Cut-O-Matic is not only a money saver in the larger plant but in small shops, too. In countless instances the low price of the Cut-O-Matic has enabled small businesses to enjoy the recognized superiority of machine cutting—with its sharper, cleaner cuts and its overall economies in time, materials and gas.

Cut-O-Matic offers so many advantages that you'll want a copy of the illustrated booklet describing the unit in detail. If you'd like a demonstration right in your own shop, just check the box in the coupon at the right.

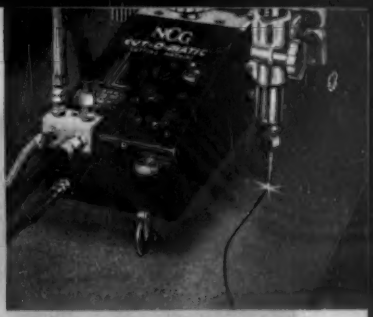
STACK CUTTING

Stack cutting gives real production economy and speed. Sheets clamped together may be cut uniformly. Circles and arcs as well as straight lines are easily stack-cut.



STRIP CUTTING

Strips up to 29-in. wide can be cut by adding torch holder, torch and hose assembly. Wider strips may be cut by using extra length equipment. Narrow strips may be cut by mounting two torches side by side.



IRREGULAR SHAPES

Limited irregular shapes may be cut by guiding the Cut-O-Matic by hand. Rear wheel is castered to facilitate travel. Cuts are much better than those made with a hand cutting torch.

FREE-WHEELING

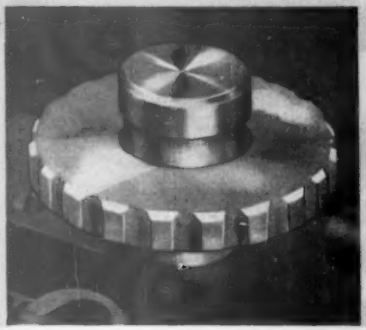
Fingertip clutch control is combined with a cross-feed gear rack adjustment to permit moving the machine on track while adjusting the cross-feed, in one simultaneous operation.

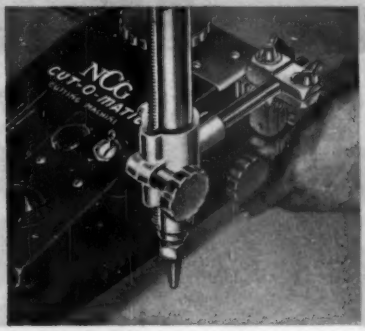
EASY CHANGE-OVER

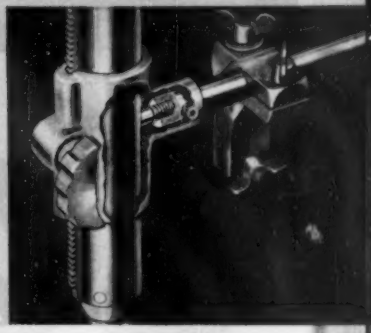
It's easy to switch from cutting straight-line to circles. The friction knob is loosened, as illustrated, and the inside drive wheel is disengaged. The outside wheel then propels the machine around the center point.

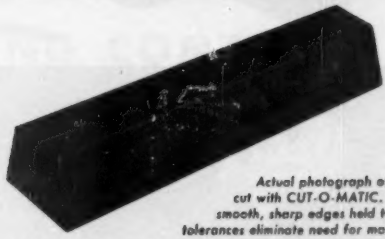
SMOOTH—RIGID

No ragged cuts caused by excessive play and uneven racking. A special clamp adjustment, plus a spring-loaded pressure plug, holds torch in rigidly, yet permits smooth racking.









Actual photograph of bevel cut with CUT-O-MATIC. Clean, smooth, sharp edges held to close tolerances eliminate need for machining or grinding.

NCG CUT-O-MATIC STANDARD UNIT

F.O.B. FACTORY, LOUISVILLE, KY

$210

Complete with torch, tip, radius rod, track, hose, cable and torch wrench.

CUT-O-MATIC possesses all the quality characteristics of famous NCG heavy-duty flame-cutting equipment. Sturdy, simply designed for efficient operation and easy maintenance, the CUT-O-MATIC is a dependable tool that will give you long trouble-free service.

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Please send me Illustrated Booklet N-134 describing in detail the versatile CUT-O-MATIC Flame-Cutting Machine.

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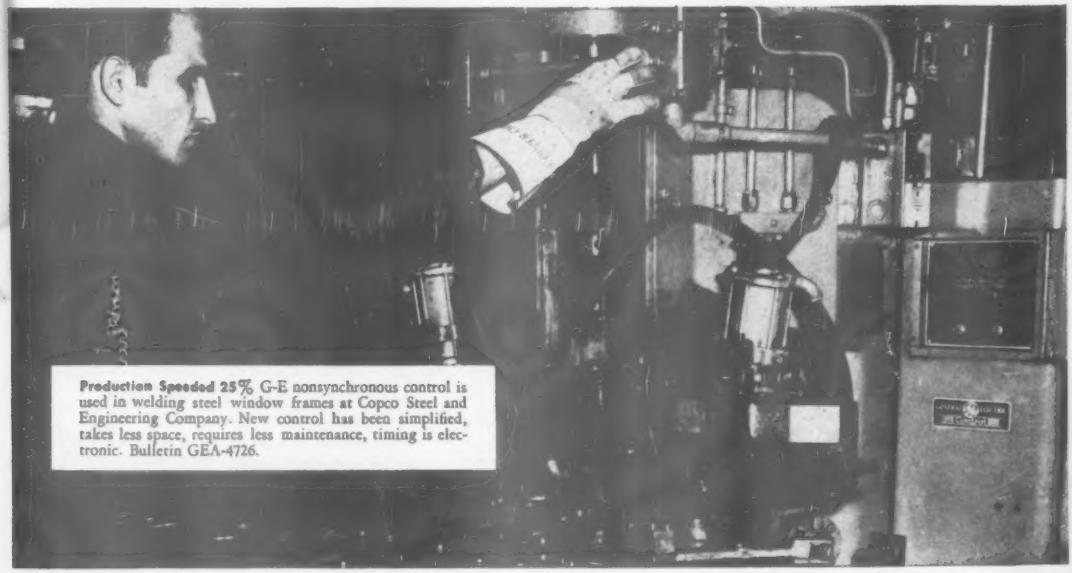
☐ I would like a demonstration in my own shop.

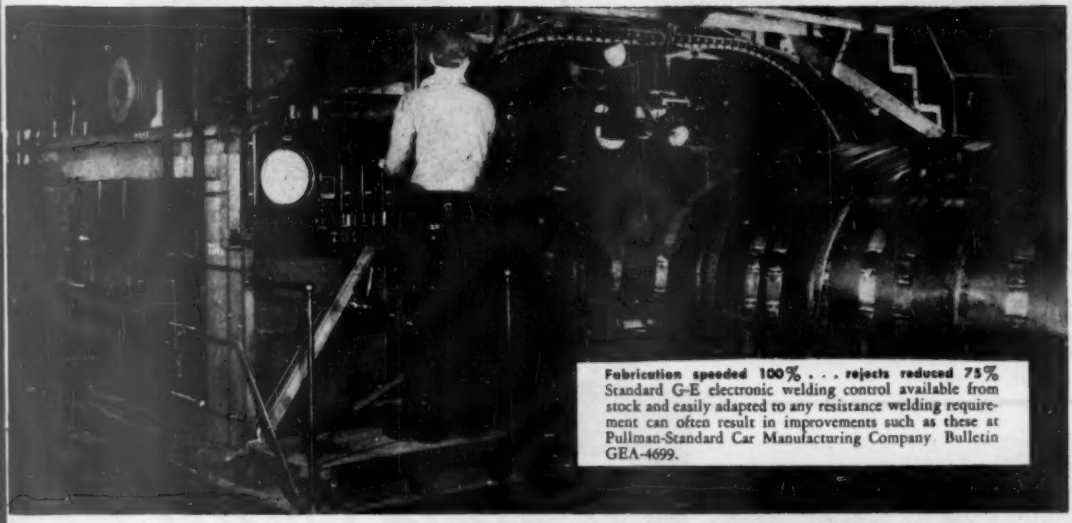
New Alloy Welded—just .007 inch thick G-E Thyratron spot-welding control is used at the Elgin National Watch Company on a Dura Power mainspring. Elgin reports, "Thanks to G-E control, work is easy, accurate, and production is high." Bulletin GEA-4175A.

One Production Step Eliminated G-E slope control so greatly reduced metal expulsion on engine hoods produced by City Auto Stamping Company that an expensive polishing operation was eliminated, quality retained. Bulletin GEC-534. Additional application stories in GET-1892.

LOOK!



Production Speeded 25% G-E nonsynchronous control is used in welding steel window frames at Copco Steel and Engineering Company. New control has been simplified, takes less space, requires less maintenance, timing is electronic. Bulletin GEA-4726.



Fabrication speeded 100% . . . rejects reduced 75% Standard G-E electronic welding control available from stock and easily adapted to any resistance welding requirement can often result in improvements such as these at Pullman-Standard Car Manufacturing Company. Bulletin GEA-4699.

4 more companies improve production

WITH G-E ELECTRONIC RESISTANCE WELDING CONTROLS

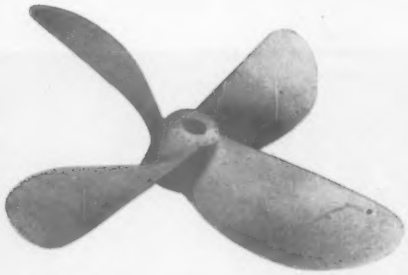
Weld faster, cleaner, and with less kva demand. Weld new alloys. There are G-E electronic controls to help *you* improve production, improve *your* product, reduce costs just as they have done in the cases described here. Take advantage of the newest improvements and developments in G-E control—the wide experience of our welding control specialists. Together with your welding machine manufacturer, they'll help you solve production problems. Write your nearest G-E office today for more information. *General Electric Company, Apparatus Department, Schenectady, New York.*

REMEMBER . . . GOOD resistance welding depends on GOOD electronic control. When you buy insist on G.E. . . . longest in the business with the most complete line of resistance welding controls. For quick and easy training of operators ask your welder manufacturer, power supplier, or the nearest G-E office for a FREE showing of the sound, all-color movie, "This is Resistance Welding," a General Electric More Power to America film.

You can put your confidence in—

GENERAL ELECTRIC

645-53



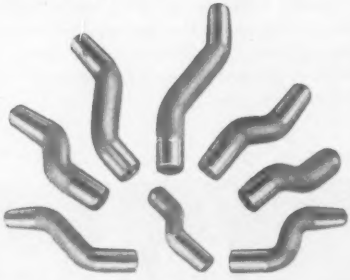
Salvage with Phos-Trode Saves Thousands — A defective keyway in this giant marine propeller might have sent it to the scrap heap. Expensive replacement was avoided by chipping out the keyway, building it up flush to the inside bore with weld metal, and machining a new keyway. Ampco Phos-Trode electrodes were selected for their dense, easily machined deposit — and for their easy manipulation in all positions.

Resistance Welding Saves $14,000 per Year Over Silver Soldering — A ⅛" diameter oil drain plug was formerly soldered in place in this deep drawn steel casing. A slight design change adapted this operation to projection welding. Annual savings: $14,000. Ampco-Weld products — the complete line of standard and special electrodes, holders and alloys, specifically engineered to give longer life, less downtime, and clean welding — can help you cut your costs, too.

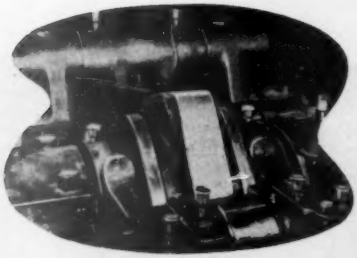
Tough Welding

Rebuilt at Low Cost, Better Than New — Ampco-Trode 160, 200, and 250 overlays save money in countless ways. This giant steel tube-mill gear "Bronze-Faced" with Ampco-Trode 250 is a case in point.

Ampco-Trode Overlays Triple Valve Life — Severe abrasive and erosive action in a carbureted water gas installation limited valve life to 4 months. They were rebuilt — with machineable Ampco-Trode 10, at ½ the cost of replacement.



Cold-Bent, Resistance-Welding Tips — for longer runs, lower costs, faster delivery, larger savings. Made without patterns or dies. Cold bending retains full, high physicals. Holes bend with metal, no special drilling required for water passages; gives you cooling right to the welding face.



Service Life Increased 1200% — Actuating cam on this cold nut blanker, when "Bronze-Faced" with Ampco-Trode 200 to resist wear, outlasts other hard-surfacing materials by as much as 1200%.

Phos-Trode Saves Time and Money in R. R. Maintenance — Phosphor bronze liners add many miles to locomotive operation. They reduce friction and wear between the driving box and wheel hubs. Installation has been simplified by welding in place with Phos-Trode, an electrode noted for its easy handling. A section is cut from the liner so it may be slipped over the axle. Each section is beveled to 45° and welded vertically with Phos-Trode to provide a dense deposit which feather-edges for a strong, reliable bond.

AMPCO®

is Easier, Faster and Cheaper

—when you use Ampco Bronze Electrodes for fabrication, overlays or maintenance and repair

- ✓ ***For welding dissimilar metals*** — steel to clean cast iron; steel or cast iron to bronze, brass or copper; and/or any of these to nickel alloys.
- ✓ ***For Corrosion-resistance*** — — extremely useful when fabricating process-industry equipment.
- ✓ ***For long-wearing overlays*** — where hardness and resistance to wear are essential requirements.
- ✓ ***For ideal bearing qualities*** — mates against hardened steel without seizing or galling.

On almost any complicated welding job you can use Ampco Bronze Electrodes to good advantage. Check the four features above — also look over the varied applications shown here. They give you a fair idea of how these versatile Ampco electrodes can save you welding time and cut costs.

Try them in your own plant. You'll find many more ways to profit from these all-purpose rods. See your nearest Ampco distributor. Send coupon for complete bulletins of money-saving Ampco electrodes (both arc and resistance-welding types) — and helpful information on welding techniques.

Ampco aluminum bronze and other Ampco copper-base alloys are available in a variety of grades to meet your exact requirements in any form you need: rolled sheet or plates, sand or centrifugal castings, forgings or extrusions, resistance-welding electrodes, corrosion-resistant centrifugal pumps and plug-valves.

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Ampco Metal, Inc., Dept. WE-2, Milwaukee 46, Wis.

I want the money-saving facts about Ampco Bronze electrodes. Send me, without obligation:

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AIRCO TRAVOGRAPH—for large-area, production cutting of a wide variety of precision parts. A motor-driven machine that moves along a track, its multiple torches are guided by an electronic tracing device that follows a simple outline or silhouette drawing.

ARE YOU GETTING "Airco Accuracy" WITH EVERY MACHINE GAS CUTTING JOB?

Whatever your steel cutting problem—from squaring and shaping of large plates and heavy slabs to quantity, precision-cutting of small steel parts—there's an Airco Gas Cutting Machine that's just suited to your needs . . .designed to do the work faster, better, at lower operating cost.

Airco Gas Cutting Machines are made in portable and stationary types, for single or multiple torch operation—all embodying characteristic Airco accuracy, rugged construction and excellent operating performance . . . insuring long, trouble-free life under heavy service loads.

Three separate and distinct tracing devices help give the Airco machines their great flexibility and accuracy: manual, magnetic and the fully-automatic "Electronic Bloodhound." With the "Electronic Bloodhound," cuts of the most intricate shapes can be made easily to specified close tolerances.

From an 8-torch Travograph, equipped with an electronic tracing device, to the portable No. 3 Monograph, each Airco Gas Cutting Machine performs a wide variety of cutting jobs within its specific operating range . . . an important feature that has made Airco Gas Cutting Machines outstanding in the metal-working industry.

So, for economy, speed, and accuracy, investigate the possibilities of using any one of the numerous Airco Gas Cutting Machines—select the one best suited to your needs. Please write your nearest Airco office for full details.

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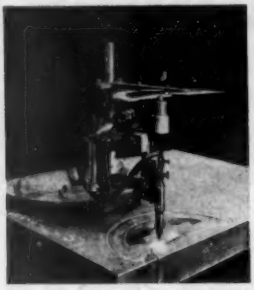
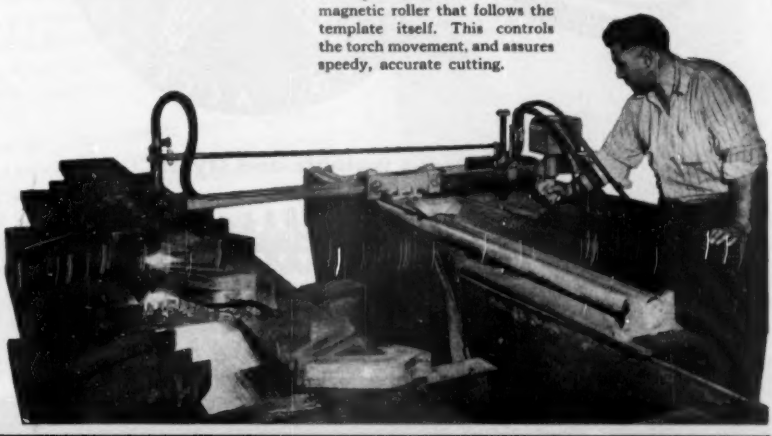
AIRCO OXYGRAPH — one of the most popular stationary shape cutting machines ever offered. Designed for single or multiple torch operation, identical parts of any design are accurately shaped in one operation — either by "stack" cutting or an individual cutting operation.

AIRCO No. 10 RADIAGRAPH — a lightweight, portable, motor-driven machine that is ideal for straight line cutting, squaring, beveling and similar cutting jobs. It cuts arcs and circles up to 85" in dia.



AIRCO No. 5 CAMOGRAPH—ideal for repetitive cutting of small shapes. It cuts parts of any contour by means of a motor-driven magnetic roller that follows the template itself. This controls the torch movement, and assures speedy, accurate cutting.

AIRCO No. 3 MONOGRAPH an inexpensive, portable shape cutting machine. Designed for straight line, circle and bevel cutting jobs in addition to irregular shape cutting—all with a high degree of accuracy. The machine is easily moved from job to job — weighing only 110 lbs.



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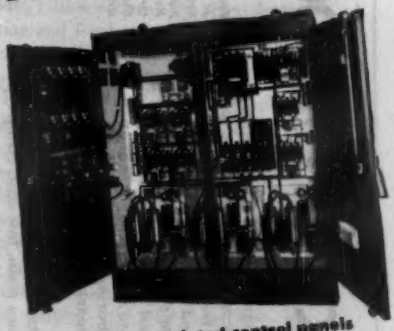
Engineering counsel on any electrical control problem is available through Square D field offices in all principal cities.



One of the completed control panels *Because Square D's line of control is so complete, this entire unit was designed using only standard devices, accessories and electronic sub-assemblies*

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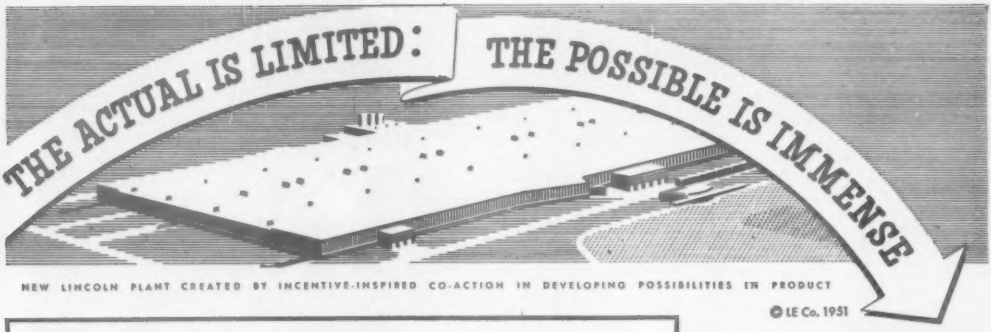


NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

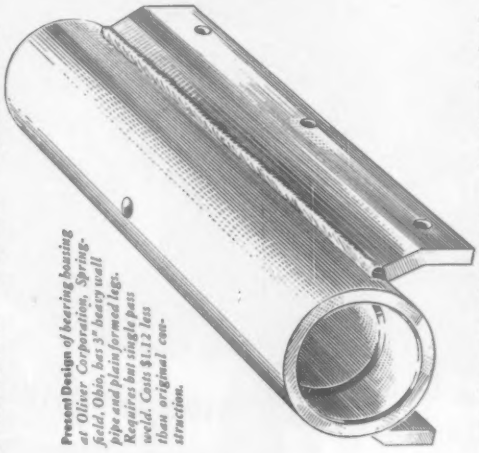
© LE Co. 1951

MANUFACTURER CUTS TOOLING COST $800.00

BY simple redesign to welded steel, substantial savings are being effected in the production of these bearing housings. At the same time, product strength and rigidity have been increased to assure maximum serviceability . . . long-lived operation. An initial saving of $800.00 on setup and tooling expense results from the elimination of drill jigs and boring fixtures as well as for patterns and core boxes required with the original construction.

Component parts are now preformed prior to welded assembly in a plain, low-cost, clamp type fixture. The tubing itself is bored as a simple lathe operation and the legs prepunched and bent as shown.

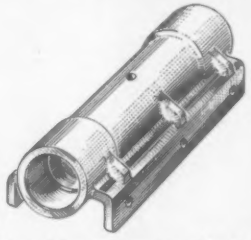
The resulting simplified production now possible with the welded steel construction is increasing the rate of output . . . reducing unit cost $1.12 per piece.



Present Design *of bearing housing at Oliver Corporation, Springfield, Ohio, has 3" heavy wall pipe and plain formed legs. Requires but single pass weld. Costs $1.12 less than original construction.*

How To DESIGN FOR WELDED STEEL is presented in the new 9th Edition "Procedure Handbook of Arc Welding Design and Practice." Contains latest data on machine design together with cost figures. Price only $2.00 postpaid in U.S.A.; $2.50 elsewhere.

the ACTUAL



Original Cast Construction *of bearing housing required fixtures for extensive boring and drilling operations.*

increasing the YIELD

First Changeover *to welded steel design has 90° formed legs welded to thin wall tubing. Was welded top and bottom as shown.*

the IMMENSITY of the POSSIBLE

A saving in cost of 24%

SEE HOW WELDED STEEL DESIGN SIMPLIFIES PRODUCTION

Machine Design Sheets free on request to designers and engineers. Write on your letterhead to Dept. 72 .

THE LINCOLN ELECTRIC COMPANY

CLEVELAND 1, OHIO

ESTABLISHED 1916 THE WELDING ENGINEER FEBRUARY, 1951

This Changing America

TIME IS the great change artist, but he specializes in slow rather than quick changes. Sometimes we fail to notice his tricks at all. Usually we notice them most in the little things of life.

Not too many years ago, children would run out of a house screaming with excitement as an airplane sailed overhead. An old slow-moving biplane. At that time an ice cream cone or soda, a bottle of pop or a 5-cent movie represented a real treat. Oranges were so rare that you seldom saw them except in your stocking on Christmas morning.

Time has changed all of this. The treats of yesterday are the commonplaces of today. No modern child is going to get excited over a movie or a bottle of pop or an ice cream soda. Time has brought new pleasures such as television sets to stimulate our jaded faculty for enjoyment.

A group of us were holding an old-fashioned bull session the other day when the discussion got around to the subject: "What has changed America the most?" One fellow thought it was the automobile because it has made it so much easier for us to to get around. Certainly, the auto has brought us all closer together and has made our once vast country seem rather small. But railroads have operated to the same end.

Other members of the group advocated radio, the airplane, movies, even such late comers as television and the atomic bomb. But the bomb hasn't changed America—yet.

My own contention was that welding has done the most to change America. I had a simple line of argument that nobody could refute: without welding it wouldn't be possible to make (or make economically) any of the things that the others had mentioned as bringing about the greatest changes.

Welding changed the airplane from a rare object in the sky to one so commonplace that it seldom attracts an upward glance. Welding made possible mass-produced autos. It has contributed greatly to changing all forms of transportation—trucks, railroads, busses. It has increased their reliability, their ruggedness and their riding comfort. It has brought quick repairs when indispensable parts broke.

I began warming up. Welding has reduced the noise level in our cities by silent construction of buildings and by one-piece rails for street cars. By making possible higher pressures and temperatures in power plants, welding has contributed to cheaper electricity (a fact few people realize). The same high-pressure and high-temperature reasons made available high-octane gasoline. And look at any article you can see around you—light bulbs, radio, pots and pans—it is hard to find anything that has not been improved by welding.

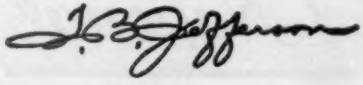
I thought I had a pretty good case, but my son Don had a better one. Don said, "It's taxes that have changed America the most." After we had considered the matter for a while, we were all forced to agree with him. And if you will just start to think about the effects of taxes, you'll see that Don is right.

Taxes are like a monstrous growth that is strangling us from within. Last year our national tax bill was 54½ billion dollars—6½ times the total of federal, state and local taxes in 1920. Though state and local taxes have not stood still, Federal taxes have increased beyond all recognition, and Mr. Average Citizen gets far less in return for them than he does from what he pays his city or his state. Lately, he has been getting only one mail delivery a day, for instance.

Poor old Mr. A. C. now works 81 days out of a total of 235 working days a year just to pay his tax bill. Nearly a third of his work to support the government! As ex-President Hoover puts it, "Existing taxes will absorb between 75 and 85% of all the savings of the people." Yet new taxes have been voted, and many more of them have been proposed.

Chief Justice Marshall once said, "The power to tax is the power to destroy." How right he was! We will be taxed right out of existence unless we wake up and do something about it. Taxed until we lose all our freedom and become the voiceless slaves of an incompetent bureaucracy.

Yes, taxes have certainly done the most to change America.



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(Outfit No. 96)

this fine cutting outfit...

has a most appropriate name.

With this outfit, you can scrap-cut swiftly, economically, and with a minimum of difficulties and repairs. This equipment was produced by the oldest manufacturer of welding and flame-cutting apparatus on the Pacific Coast; by an organization which has engaged in both gas and electric welding and flame-cutting for over forty uninterrupted years.

This wealth of experience is manifested by the quality of this equipment. Even a cursory examination and test will indicate instantly the reasons *why you will find this equipment superior* in every respect. Examine it carefully, try it . . . and let the salesman explain to you the many outstanding advantages. Remember, these cutting outfits were born on the toughest jobs you can imagine; *they had to stay out of repair shops*—they had to perform reliably—they had to cope with every kind of flame-cutting operation.

There is an ideal *NATIONAL* flame-cutting outfit to meet every requirement—to utilize any useful fuel gas—with every modern cutting tip type and in all capacities. Let the salesman help you in the selection.

prudent dollars can buy no finer cutting outfit . . .

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Remember—only genuine TUBE-TURN Welding Fittings are identified by these trade marks!

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Unique forging process gives strength

TUBE-TURN WELDING FITTINGS have a close-grained metal structure fully as strong as the pipe to which they are welded. Welding elbows, for example, are forged by the only process that achieves wall thickness as uniform as the original seamless pipe . . . guaranteeing *full strength throughout*. And, their true circularity means accurate alignment, regardless of angle, for strong, tight, permanently leakproof connections.

Forged-in strength is inherent with all types of TUBE-TURN Welding Fittings. It's one of the big reasons why it pays to specify them for *all* jobs. Get in touch with your nearby TUBE TURNS' Distributor. You'll find one in every principal city.

Write Dept. N-2 for free booklet giving Dimensional Data on types, sizes and materials of TUBE-TURN Welding Fittings and Flanges.

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Wrought iron downspout welded on Cleveland Bridge

Cleveland's Abbey Avenue Bridge is big enough to collect a lot of water in a rainstorm. To get rid of it, nine downspouts, ranging from 39 to 66 feet in height, carry the water to underground sewers. Wrought iron pipe was chosen for its resistance to rust. All-welded piping was chosen for long life, structural rigidity. Weak joints here could be fatal!

Contractor on this job, the Gorman-Lavelle Company of Cleveland, likes speed on the job. The piping itself was quickly fabricated on the ground, then raised into position. Piping went up fast—and safely!

A lateral connection near the top of the spout leads up to drains on the bridge. TUBE-TURN Welding Reducers are installed at the very top of the spout. The drain sets in the reducer with a loose fit, allowing 2" clearance all around. Thus the bridge can expand on its roller bed without disturbing the pipe. TUBE-TURN Welding Reducers, Elbows, Laterals and Caps are all part of the leading line in welding fittings.

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Note TUBE-TURN Welding Elbow at bottom of downspout. Drain pipe will be connected to underground sewer. Underground, too, a system welded with TUBE-TURN Welding Fittings is the best long-term bet—there are no threads to corrode, the problem of leakage is eliminated.

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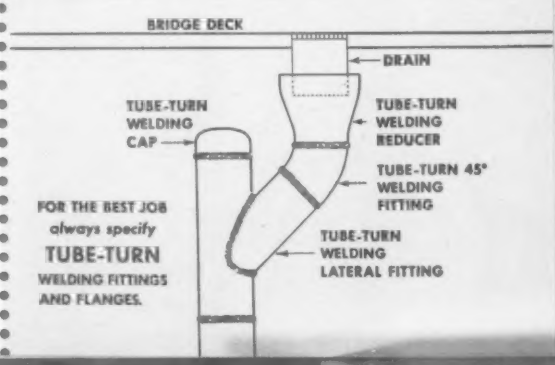
BRIDGE DECK
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TUBE-TURN WELDING CAP
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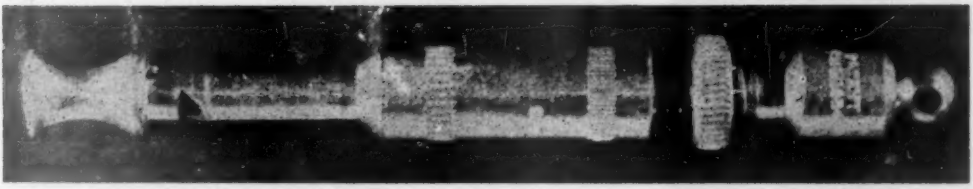
TUBE-TURN 45° WELDING FITTING
TUBE-TURN WELDING LATERAL FITTING
FOR THE BEST JOB always specify TUBE-TURN WELDING FITTINGS AND FLANGES.



WHISTLES have been used in the laboratory to generate ultrasonic energy but are not suited to practical use

Is the Industry's Next Big Advance

Ultrasonic Welding?

Already a British manufacturer has announced a soldering iron with a magnetostriction transducer: it will break up the oxide films on aluminum while soldering. Will the welding of tomorrow be done ultrasonically?

BY THOMAS A. DICKINSON

THE COMPARATIVELY new science of ultrasonics has opened up what could easily become a most fertile field for new developments in equipment and accessories for welding and related processes such as brazing and soldering. However, virtually all of the subject developments to date must be attributed to foreign manufacturers such as Mullard Electronic Products, Ltd., of London, England.

To start from the beginning: Ultrasonics can be briefly described as the science of high-frequency or high-intensity sound waves or vibrations, most of which are beyond the hearing range of the human ear. Such waves or vibrations can be generated with at least three different types of equipment:

Ultrasonic Generators

(1) *Siren generators:* ultrasonic energy is created by ejecting air pressure through a pair of perforated discs, one or both of which may be rotated at various speeds for different frequencies, or by using a "squirrel-cage" blower to create and break up a flow of air for a perforated stator. Frequencies are dependent on the number of perforations in stator and rotor components as well as on the rotational speeds of moving parts. Intensities are dependent on the amount of air pressure in the siren housings.

(2) *Crystal "transducers" or piezoelectric crystals:* these are energized with the output terminals of a radio-type amplifier so that ultrasonic vibrations will be produced by the rapid expansions and contractions of the crystals. Frequencies are dependent on the amount of energy used to vibrate the crystals and the resonance properties of the crystals. Intensities are proportional to the crystal dimensions.

(3) *Magnetostriction generators:* these produce ultrasonic vibrations by rapid expansions and contractions in ferromagnetic rods, tubes, etc. It's done by placing the rod or tube in an electromagnetic field polarized with oscillating current. Frequencies are dependent on the nature of the ferromagnetic vibrator and the oscillations of the electromagnetic field. Intensities are proportional to the dimensions of the vibrator and to the energy utilized by the electromagnetic field.

The dimensional changes occurring in ferromagnetic materials when they are placed in a magnetic field are very small. Even in nickel, one of the most magnetostrictive of materials, the greatest change per unit length is only about 30 parts in a million.

Tuning forks, whistles, electrical spark gaps and various friction devices have been used to generate ultrasonic energy for classroom demonstrations, laboratory experiments, etc. An example is the "Galton pipe" shown at the beginning of this article. But none of these laboratory methods are considered practical for a majority of industrial applications.

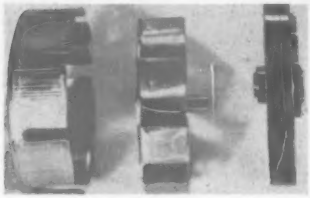
Which One Is Best

Sirens are regarded by many authorities as the most practical ultrasonic generators for many purposes because they can be designed and controlled for output-energy values of virtually all frequencies and intensities (up to about 200 decibels and 500,000 kilocycles, respectively).

Crystal transducers can produce ultrasonic vibrations of virtually all frequencies. Use, hitherto, has been limited to fairly low intensities due to the fact that natural piezoelectric crystals (such as quartz and Rochelle-salt crystals) are fairly small in size and have a tendency to melt or crack at high operational temperatures. However, it may be possible that most of the limitations of crystal generators can be eliminated through the use of artificial piezoelectric elements. These have recently been fabricated from ceramics by the Brush Development Co., Cleveland.

Magnetostriction generators are exactly the opposite of the crystals: they can produce vibrations of considerable intensity but are believed at this writing to be limited to a frequency output of less than 100 kilocycles.

Types of Ultrasonic Generators



1. Siren Generator

AIR IS ejected through a pair of perforated discs, one or both of which may be rotated at various speeds for different frequencies. Frequencies are dependent on the number of perforations in stator and rotor components as well as on the rotational speeds of moving parts. Intensities are dependent on the amount of air pressure in the siren housings.

2. Crystal Transducers

PIEZOELECTRIC crystals are energized with the output terminals of a radio-type amplifier so that ultrasonic vibrations will be produced by the rapid expansions and contractions of the crystals. Frequencies are dependent on the amount of energy used to vibrate the crystals; intensities are proportional to crystal dimensions.

3. Magnetostriction Transducer

ULTRASONIC vibrations are produced by rapid expansions and contractions in ferromagnetic rods or tubes. The rod or tube is placed in an electromagnetic field polarized with oscillating current. Frequencies are dependent on the oscillations of the electromagnetic field and the nature of the vibrator; intensities are proportional to dimensions of the vibrator and to the energy utilized by the electromagnetic fields.

For welding and related purposes, the usefulness of ultrasonic energy can be attributed to the following properties:

(*a*) At high frequencies (300 or more kilocycles) tremendous quantities of heat energy are produced by means of ultrasonic vibrations. According to Norman Barnes, of the General Electric Co., a kilowatt of ultrasonic power may be concentrated within a square centimeter of area —this is about ten times the energy concentration of a white-hot tungsten lamp filament. The high energy concentration no doubt explains why British manufacturers have successfully used ultrasonic sirens to weld "superalloy" steels with unprecedented efficiency.

(*b*) When a molten metal or any liquid is ultrasonically stimulated, the phenomenon known as "cavitation" occurs. We can describe cavitation as high and localized pressure that tends to break up air bubbles in the fluid so oxide impurities will rise to the surface of the material. To achieve the cavitation effect, the Mullard organization has developed a soldering iron. The conventional copper soldering bit is heated by means of usual resistance winding and is simultaneously vibrated by a magnetostriction transducer.

(*c*) Ultrasonic vibrations may be propagated in or reflected by liquids, solids or gases in accordance with the resonance properties of various materials. Among other things, this means that ultrasonic heat energy can penetrate metallic materials with comparative speed (much the same as radio-frequency heat can penetrate dielectric materials). It also means that ultrasonic impulses can be used for weld inspection, of which we will say more later.

ULTRASONIC SOLDERING IRON

A few more details about the Mullard ultrasonic soldering iron are furnished from the London Bureau of McGraw-Hill World News. Used to solder aluminum and other light metals, the soldering gun proper consists essentially of a removable copper soldering bit and a magnetostriction transducer. The transducer is composed of a stack of nickel laminations wound with an insulated excitation coil; it has a high-impedance pick-up coil attached to it.

The soldering bit, heated by means of a conventional resistance winding taking power of about 120 watts, is secured to a metal block held in firm contact with the nickel core of the transducer. The rapid vibration of the soldering bit, resulting from the magnetostriction effect produced in the transducer, is used to break up the highly refractory oxide films that form on aluminum, etc.

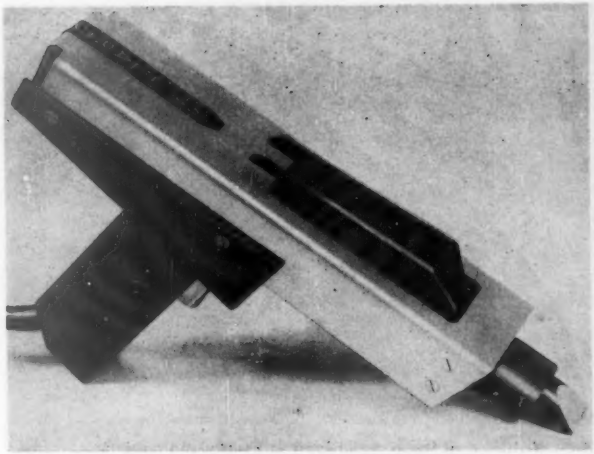
The soldering procedure is quite simple. As with an ordinary soldering iron, the bit is allowed to heat to its operating temperature. The transducer is then energized by switching on the electronic amplifier comprising the power supply unit. The bit is tinned by applying a soft solder, after which soldering is carried out in the normal way. A particularly important feature of this new soldering iron is that no flux is required.

SOLDERING OF ALUMINUM

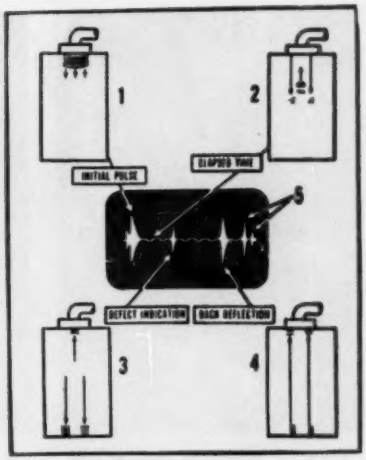
The favorable effect of ultrasonic vibrations on the tinning of aluminum and its alloys is probably due to the exposure of a clean surface through the erosion of cavities in the oxide skin. To secure evidence of this theory, Mullard's B. E. Noltingk and E. A. Neppiras immersed a specimen of aluminum in a bath of molten solder. To the bath were communicated vibrations at a frequency of 18 kc by applying 50 watts to the driver coil of a small magnetostrictor. Though the exact amplitude of oscillation in the bath could not easily be determined, it was adequate to tin an aluminum surface immediately at atmospheric pressure.

The experiment was repeated with all conditions the same except that the ambient pressure was increased to four atmospheres. Tinning was completely prevented. The increased pressure, state the experimenters, would have had negligible effect on any other factor than cavitation. It therefore seems convincing to them that cavitation plays an essential part in the tinning of aluminum. It follows logically that the effectiveness of the ultrasonic technique for tinning different metals will be related to their susceptibility to cavitation erosion. Limited studies so far carried out support this deduction.

Messrs. Noltingk and Neppiras also contend that ultrasonic cavitation and, consequently, tinning must be expected to be more severe at lower



SOLDERING IRON developed by a British manufacturer. Its chief asset is a magnetostriction generator, used to break up oxide films



HOW ULTRASONIC impulses are generated, propagated, reflected and received

frequencies. Claims have been made for successful tinning at frequencies as high as 1,750 kc, but experimental work with a 1,000-kc crystal suggests that much lower ranges are most satisfactory in this class of work.

Ultrasonic Inspection

As stated (paragraph c), ultrasonic impulses can be used to inspect soldered joints, braze welds and other materials or components that can't be non-destructively tested with X-rays or magnetic-particle inspection equipment. Two highly efficient ultrasonic test units—the "Reflectoscope" and the "Reflectogage"—have already been developed by one American manufacturer (Sperry Products, Inc., of Danbury, Conn.). Each of these instruments makes use of a crystal-type generator to produce ultrasonic energy with a predetermined resonance value as necessary for propagation in various materials.

One of these instruments can generate impulses that can be propagated through more than 30 feet of solid steel and reflected back to the generation source by air on the opposite side of the steel. Thereafter, the reflections are amplified with electronic equipment and used to actuate a cathode tube (similar to the picture tube of a television set). The flaws found in the material will thus be visually indicated in accordance with the time required to produce the reflections.

For materials or products that cannot be readily inspected with standard measuring instruments or gages, the cathode tube of the "Reflectogage" is designed to provide visual indications with reference to the presence or absence of specified dimensions.

Other ultrasonic applications that do not merit a detailed discussion in this particular article are nevertheless worth noting. They include such difficult tasks as the alloying of copper and iron, the precipitation of industrial smoke and fumes, the dispersion of immiscible liquids (water and oil), the agitation of solutions and the drilling or machining of extremely hard or brittle materials with relatively great efficiency. The agitation of solutions is more important than it seems: this application permits various materials to be cleaned, degreased or pickled with greatly increased speed.

It was previously stated that no American manufacturers are yet known to have developed ultrasonic equipment for specific use in welding or related processes. This is true, but the three most practical types of ultrasonic generators are available for other purposes than welding through a number of companies in the United States. If you're interested—

Siren generators have been made by Ultrasonic Corporation, of Cambridge, Mass., and G-B Brass & Aluminum Foundry, Inc., Los Angeles; magnetostriction generators are being produced by Massa Laboratories, Cleveland; crystal generators can be obtained from Fisher Scientific Co., of Pittsburgh, and General Electric Co., Schenectady, N. Y., as well as from the Brush Development Co., Cleveland. Furthermore, the ultrasonic soldering iron and other products of the Electronic Equipment Division of Mullard Electronic Products Ltd. are being marketed in the U. S. and other overseas countries by Mullard Overseas Ltd., Century House, Shaftesbury Ave., London, W.C. 2.

Technical information that should stimulate the development of ultrasonic equipment for virtually all purposes is now available through a variety of educational institutions. Among them are: Pennsylvania State College, University of California at Los Angeles, Battelle Memorial Institute at Columbus (Ohio) and the National Bureau of Standards at Washington, D. C. Technical books are listed in the bibliography:

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1—SPOT WELDING rings to hold bulkheads to the skin of the tank

2—SUBASSEMBLY of main bulkheads, stiffeners and longitudinal supports is now ready to be installed in one of the half shells of the tank

How We Built a

Jettisonable Fuel Tank

Best production design was obvious: two half shells to be joined by some welding method. But what are you going to do when the biggest drawing press available lacks 2½ ft of being long enough for the forming?

BY A. H. PETERSEN

Production Design Engineer, Lockheed Aircraft Corp., Burbank, Calif.

DUE TO present world conditions, the problem of extending the range of modern aircraft is one that all aircraft engineers are wrestling with today. A case in point is the remarkable performance of the Navy plane "Truculent Turtle," which bridged the gap between Australia and this country in 1946 for a total of 11,236 non-stop miles.

More miles covered means more fuel carried, means a place to put the tanks necessary for the fuel. As always, the wing tips become a target. In the particular plane concerned, the problem was aggravated by tight aerodynamic requirements. Optimum smoothness of external surfaces was mandatory. Tanks are usually assembled from a large number of component parts, which makes it difficult to give sufficient consideration to drag and instability that may be imparted to wing tips in certain attitudes.

The average designer would like a tank of no weight and no joints. This being impossible as yet, he compromises as a rule on the lightest skin possible and takes out the load in the internal structure. If his factory has limited facilities, the skins are broken down into a number of pieces, and the more pieces the more complex the splicing problems and internal structure. Of course, this makes the tank more difficult to build. What's more important, everyone concerned is driven crazy attempting to seal it against fuel leakage. The joints and seals not only complicate manufacture and maintenance, but the usual slosh and vibration tests can generally be depended upon to shatter the designer's pride in his brainchild. This period of testing is usually interrupted from time to time to add a few clips and stiffeners and to repair localized leaks. Needless to say, the final tank often presents a patchwork appearance.

The designer's choice of materials is limited to those resistant to corrosion, which must be avoided at all costs. The coatings protecting internal members must not peel, crack nor dissolve under the action of aromatic fuels. Dissimilar metals must be insulated. Sloshing compounds are difficult to handle on large tanks; spray-type sealing compounds require a number of access openings, which in turn present more sealing problems and add weight.

The job of designing and building a 300-gallon jettisonable wing tip tank brought into study and discussion all the aforementioned problems.

JOIN TWO HALF SHELLS

The optimum external design was a cylindrical streamline shape 34 in. in diameter by 16½ ft long. The best production design was obvious: two half shells to be joined by some method of welding. These could not be formed. Lockheed's drawing press, a 1,500-ton Clearing, was as big as any press on the Pacific Coast but lacked 2½ ft of being long enough.

3—MAIN BULKHEAD subassembly is being installed in the prototype tank, BT (before tooling). Simplicity and speed with which the assembly could be made proved an important factor in the excellent production rate

4—OUTRIGGERS were built to extend each end of drawing press

5—LOOKING INTO die assembly. Pad inside bottom die was mounted on press platen. Purpose is to form a depression in bottom shell for a pump

The welding fixture that would be required would also take time and money to design and build.

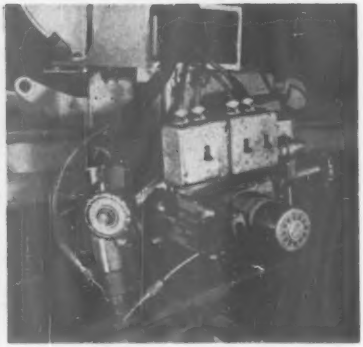
For a while, it appeared that a good idea had died aborning because of equipment limitations. We would have to build and test a single tank to prove the design. If we missed the boat, we would wind up with a lot of unrecoverable expenses. For once, however, we had sufficient time to make a good production design study. The final design could be completely tested before production started, and there would be ample time to provide manufacturing facilities if the basic design could be frozen early enough.

The loads considered in the design consisted of the dead-weight inertia load with factors imposed for the various flight and taxiing loads. Flight data substantiated wind tunnel tests.

Spacing of the two main bulkheads was established by the necessity of mating with the wing tip attachments. As a minimum of baffles were to be used, the most critical condition, it developed, was when the tank was approximately half full. Then the calculated pitching moment would cause maximum surge and resultant load transfer to either front or rear of the main bulkheads. Under this condition, maximum bending and shear loads would also be imposed on the half shells.

The main bulkheads were also designed to take the spanwise loading occurring during the aileron roll condition. The vertical shear loads mainly dictated the number and size of the stiffeners on the bulkhead webs. These stiffeners also helped support the bulkhead webs against any eccentricities imparted by the shackle tension fittings.

6—SPOT OR SEAM WELDING joined interlocking stiffeners to shells. Location of the spots affected the circumferential arc weld



8—AUTOMATIC welding head on assembly fixture. Note the rod-feed mechanism

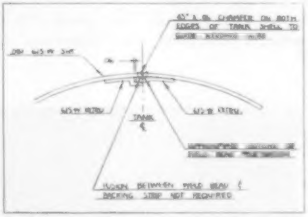
It was considered desirable to spot weld bulkhead rings to the skins to avoid rivet sealing. The wisdom of this was questioned in some quarters, for in designs of this type spot welding often gets a black eye. The usual procedure is to form the bulkhead on a rubber press and then use the welder electrodes as clamps to force bulkhead and skins into contact for welding. Thus preloaded in tension, the welds are readily susceptible to failure after a few flights. Spot welding is then eternally damned.

Bulkhead Subassemblies

We solved the problem by separately attaching the bulkhead rings to the skins (Fig. 1). A subassembly was then made of the main bulkheads, stiffeners and longitudinal supports (Fig. 2).

The installation of this main bulkhead assembly into the prototype tank, BT (before tooling), is shown in Fig. 3. The doublers for the access doors and the fore and aft transverse rings were also installed at this time. The simplicity and speed with which such an assembly can be made proved an important factor in our excellent production rate.

Coördination was a considerable problem. There were so many interests involved—design, tooling, production and purchasing—that regular bulletins were issued to put in writing the agreements reached during meetings and in huddles over the drawing board. It is seriously doubted that things would have proceeded to such a satisfactory conclusion without this special attention.



7—SECTION of the longitudinal weld joining tank halves together

To accelerate the building of a test tank, it was agreed that Engineering would order six tanks and the necessary minimum tooling to fabricate them. Engineering would also make certain commitments relative to design in order that the tooling organization could proceed with some assurance that the basic and expensive tools would be used in the production order.

The tooling organization agreed to carry through the entire development with the assistance of production personnel as needed and assigned an engineer full responsibility for producing the first tools and tanks.

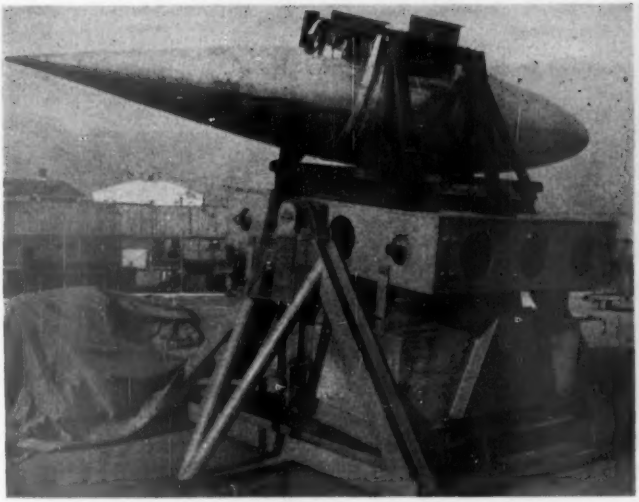
Outriggers Extend Press

Proceeding with the basic premise of two half shells, outriggers were designed for the 1,500-ton press to accommodate a die and hold-downs of the required length. These outriggers are shown in Fig. 4. The half shells were to be drawn of 61SW aluminum alloy sheet, 0.081 in., the best compromise for strength, rigidity, drawing and weldability.

On the basis of experience gained in the production of drop tanks for P-38 and F-80 airplanes, a bottomless die, rather than a more costly full cavity die, was planned. With the contemplated draw rings nearly 20 feet long, it was estimated that 450 tons of hold-down pressure and 300 tons of draw pressure would be required. Actually, the full 500 tons clamping pressure capacity of the press was used in the final sizing of the part. The outriggers, extending 32 in. beyond each end of the 14-ft press platen, carried five pressure pins to control clamping forces at the extreme ends of the draw rings. Deflection of the outriggers under full load proved to be less than 0.015 in.

The hold-downs were cast in segments of Kirksite and made 8 in. thick to minimize warpage and deflection. Tied together by steel splice bars, this assembly weighed 22,000 lb and provided 6,100 sq in. of clamping area. The upper half shell required a depression in order to fit close under the wing, and the bottom half had to have a depression to accommodate a pump. A Kirksite punch was cast in three sections. Two interchangeable center portions were made; each formed one of the required depressions when entered by a bottoming pad mounted inside the die on the platen of the press, where it was operated by the cushion pins. The die was cleared to metal thickness and the draw radius set at ½ in. Fig. 5, a view into the bottom die, shows the pad on bottom cushion that forms the pump depression.

It was first decided that the form-



9—STREAMLINED TEARDROP was given vibration and slosh tests after welding and application of rubberized coating. A special jig was devised

ing would be a conventional draw operation to within the last inch of draw, at which time blank restraint would be increased and the part finish stretched. Best results were achieved, however, by partially forming the shell in the annealed condition, heat treating it and finish forming as soon thereafter as practicable. We had found that SW sheet "as received" has physicals within a wide range, and although the aging curve is very gradual, the variation could cause trouble on critical draws. First draw was to within 1 in. of bottoming.

A blank size of 60 by 216 in., with corners reduced, worked well. No puckers occurred along the sides, and the ends ironed out. Some failures occurred at the tail end, but these were overcome by reducing the blank in this area and allowing the metal to pull out from under the draw ring. The first shells were surprisingly accurate with little longitudinal bow. Bowing had been expected to be a problem when the shells were trimmed ½ in. below the draw radius because of the critical aspects of the welding techniques employed.

It was probably fortunate that 0.081-in. material was used. Later experiments showed that lighter gages developed vertical puckers and a degree of longitudinal bowing that would not have met the smoothness requirements of the aerodynamicists. Incidentally, the 0.081-in. material thinned down to 0.074 in. in the areas of maximum stretch.

Butt Weld a Must

A considerable number of tests were run to determine the optimum joint for the half shells. The previously mentioned aerodynamic requirements made butt welding a must. To produce a good joint strengthwise and one without steps and bulges, the abutting edges of the two half shells would have to fit accurately and be held firmly. Two special extrusions were designed to fit inside the shells at the weld joint for the purpose of maintaining the alignment. The separate segment around the nose was stretch formed to contour while the side segments were sprung into place at the time of attachment. After trimming, these interlocking stiffeners were seam or spot welded to the half shells (Fig. 6). The location of the seam weld was found critical in relationship to the joint arc weld. If too close, heat was pulled from the arc weld too swiftly, the extrusion acting as a chill strip. If too far away, the spot welds were pulled by distortion in the arc weld.

A sketch of a typical cross-section is shown in Fig. 7. Manual arc welding was not considered feasible because of the length of the joint, the surface smoothness requirements of the weld bead and the human element that enters into and determines the quality of manual butt welds. Automatic welding would meet or minimize these problems and requirements. Automatic equipment would also allow constant speed, controlled heat input and uniformity of expansion and contraction stresses so that the 61S aluminum alloy would be welded with a minimum amount of cracking.

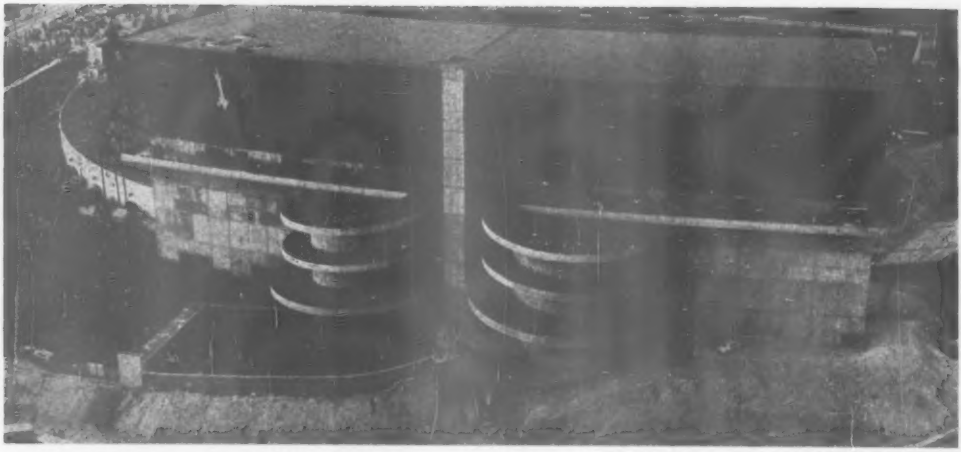
Rod-Feed Mechanism

Tests showed the feeding characteristics and speed controls of a rod-feed mechanism to be satisfactory for the type of work. This device feeds a continuous spool of welding wire by means of variable speed, power-driven serrated rolls. The rod is directed toward the welding arc through a tube and nozzle. The direction and location of the rod upon entering the arc were found critical. Tests also showed that the rod should contact the work prior to and during the time that it was entering the arc stream. The geometry of the weld bead could be varied by adjustments in welding speed, feed speeds and heat settings. The traveling welding head on its assembly fixture is shown in Fig. 8.

Tests proved the best welding speed to be 20 ipm, using ⅛-in. 3S rod at 85 amp. An entire side was welded in one pass to within 6 in. of each end. The tank was then reversed in the jig, and a pass was made on the other side. These passes were purposely laid high with a minimum of undercutting in order that the weld might be shaved flush with the skins if found necessary. We had planned to accomplish this by mounting a high-speed spindle and flycutter in a guiding device essentially the same as that employed for the welding head. The bead has been so uniformly flat, however, that such a device has not been required.

The tank was removed from the jig in order to finish the ends manually. After completion of the weld assembly, the transverse rings in the nose and aft portions were riveted across the weld line by means of tabs (clearly visible in Fig. 3). These

(*Continued on page 42*)



CONCRETE SPIRAL ramps for the new addition to the stadium. Top of these twin ramps is 105½ feet above the playing field. The addition provides 15,000 more seats for home football games at the University of Washington

Seattle's New

Using welding saved about 200 tons of steel or $40,000 by eliminating gusset plates and rivets. It also cut construction time, resulted in a stronger structure.

BY RAY BLOOMBERG

THE $1,500,000 addition to the University of Washington stadium at Seattle comprises "the biggest welding job ever performed in a building structure," according to university officials. While the assertion is open to argument, the structure is probably designed to carry heavier loads, up to 1,500,000 lb at critical joints, than any other welded building structure. Correspondingly, the framework is 33% stronger than recommended by American Welding Society specifications for stresses in welds in tension.

When the university decided to build the 15,000-seat addition, time was "of the essence" and the major factor resulting in the choice of welded steel construction for the first time on a major stadium project.* Work could not begin until April, yet the stadium had to be completed by the start of the football season on Sept. 23. It was felt that welding would save several weeks of construction time, and the belief was justified.

To insure that the strength of the structure would be adequate to the loads imposed by 15,000 jumping, cheering, wildly excited football fans watching a touchdown play, magnetic-particle inspection was used on every critical joint. Furthermore, one out of every five joints was subjected to gamma-ray inspection. This is said to be a greater degree of inspection than has been exercised on any similar project.

CARBON-ARC GOUGER

Another rather unique feature of the stadium construction was the use of a carbon-arc gouger for deseaming welds. This tool utilizes a carbon electrode at 350 amp in combination with compressed air at a pressure of about 125 psi. A development of the Navy Department (see THE WELDING ENGINEER, April, 1950, page 54), it is now manufactured commercially. The gouger was able to accomplish in 10 minutes the same amount of deseaming a flame gouger would need an hour to do, according to O. J. Smith, erection superintendent.

CARBON-ARC gouger combines arc with compressed air at 125 psi to do a fast job of deseaming welds

Welding has resulted in the saving of about 200 tons of steel or $40,000 as the result of a structural design that eliminates gusset plates and rivets. The sleek streamlined design of the stadium (see pictures) was originated by Sigmund Ivarsson, consulting engineer for George W. Stoddard & Associates, the project architects.

Contributory reason for the choice

*Welded steel grandstands seating 10,054 persons were built at Troy, O. See "Low-Cost Welded Stadium," THE WELDING ENGINEER, July, 1950.

AERIAL PHOTO shows the addition's unique cantilever roof. Except for ten steel struts, ten rows from rear, roof is wholly supported by rear wall. Most spectators thus have an unobstructed view of the game's big moments

Welded Stadium

FIELD WELDING a joint. To insure good welding, one out of every five joints was inspected by gamma rays

of welded construction was an ample supply of weldors and a shortage of riveters. Many weldors were trained in Puget Sound shipyards during World War II, whereas riveters are in short supply around Seattle because of the limited amount of steel construction.

Cantilever Roof Design

Original plans called for a cantilever roof 400 by 150 ft, supported only by the rear wall. This would have given every seat an unobstructed view of the playing field. Unfortunately, the plan could not be entirely carried out. Testing of a model in a wind tunnel indicated that a strong wind (a 50-mile wind from the north) in combination with 4 ft of snow on the roof might cause vibration in the roof. Though these conditions have never existed in Seattle, the university's board of regents decided to play it safe and ordered the installation of stiffeners. As a result, ten steel struts were erected ten rows from the rear.

Shop and Field Welding

It is notable that about three-quarters of the total welding was done in the shop. Consolidated-Western Steel Corp. did some 25% of the welding in its Maywood, Calif., plant, and Pacific Car & Foundry Company's structural steel division did the assembly welding (about half of the total welding) in its Seattle plant. The latter company put out 101 welded subassemblies, the biggest weighing 24 tons and measuring 80 ft long by 26 ft wide. These giant welded assemblies were trucked through town to the stadium in the early morning hours to avoid traffic. The welds made on them were exceptionally heavy vee-type butt and fillet welds, requiring six tons of welding electrodes. The beam on the long side of the addition is exceptionally heavy, weighing 440 lb per foot.

The field welding required 17 weldors, 30 welding machines. The weldors were selected through competence tests given by the university. Most of the steel welded was 2½ in. thick, 3 in. for column webs. E-6010 electrodes were used in 5/32 and 3/16 in. sizes. Machine settings varied from 25 to 40 volts, 124 to 145 amp, depending on the electrode size and the welding position.

The completed structure not only adds 15,000 seats in 59 rows but also covers 30 rows, with a total of 5,000 seats, in the old stands. Fourteen rows of old wooden seats were replaced with 20 rows of new steel seats. The new addition also includes toilet facilities designed to meet demands of a crowd of 25,000 persons.

• • •

The firm of Strand & Son had the general contract for the addition, while Consolidated-Western Steel Corp. did the steel erection. Contract for the gamma-ray and magnetic-particle inspection was given to the Robert W. Hunt Co., inspection and consulting engineers of Chicago, represented on the job by Kenneth Walmsley.

SPARKS and hot slag from welding and cutting jobs may start fires unless proper precautions are taken

IF YOUR WORK is near combustibles, take it to a place where there is no chance of starting a blaze

Welding Won't Cause

IF a man is kept on the scene for half an hour after the welding or cutting is finished to make sure that that smoldering fires don't start.

IF another workman is nearby to watch the welding. Because of his helmet or goggles, the weldor can't always see small fires as they start.

IF no welding or cutting is done in or near rooms containing flammable vapors or liquids.

IF all flammable vapor, liquids or solids are wholly removed from a container before any welding is done on it.

IF wooden floors are swept clean and wetted down in the vicinity of a welding operation. Or better yet protected by sheet metal.

IF welding and cutting torches, hose lines and regulators are always kept in good operating condition.

IF weldors wear safety clothing, including high shoes, and have no open pockets or cuffs in which sparks can lodge.

AND IF a fire does start up, it can be put out in a hurry if the right type of fire extinguisher is on hand. Know your A-B-C-'s of fires and fire extinguishers.

BY P. C. HENSLER
Fire Protection Institute

INDUSTRIAL fire losses have increased 68% in the past ten years. At the time when industry is being called upon to step up defense needs and to sustain a strong civilian economy as well, effective fire protection and fire prevention are both indispensable.

Open flames, including welding and cutting torches, start approximately 9% of industrial fires. This figure seems small, but it still accounts for more than 5,000 fires yearly at a cost of nearly a million dollars. Not many of these 5,000 fires are caused by welding, but some of them are.

PLASTIC PLANT BURNED UP

Last year the plant of the Allen Manufacturing Co., a plastic manufacturer of Columbus, O., was destroyed by a spark from a weldor's torch. Careless use of an oxyacetylene torch also caused two fires in an auto parts plant at Hamtramck, Mich. The first fire was extinguished with relatively little damage, but the second flashed over an accumulation of paint residue on the walls and roof and was beyond control when the fire apparatus reached the scene. Total damages—$360,000. The million-dollar Masonic Temple fire in Atlanta last September was attributed to lack of adequate fire precautions during a welding repair job.

The usual aftermaths of fire—lost hours of production, medical costs and business failures—are often of more significance than the value of the industrial property involved. Those operators who have seen production seriously hampered by large-scale blazes know the pitfalls of lost man-hours, damaged equipment and charred stock. The climb to reach peak production is a long, difficult one and many customers fall along the wayside when the fire-damaged plant is unable to meet normal demand.

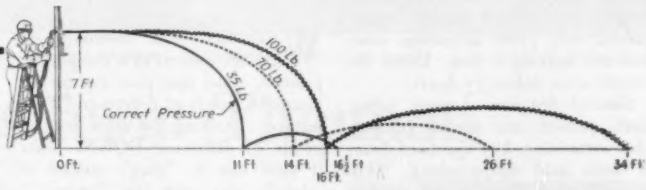
Most of the costly fires we have in this country are inexcusable. Experts in the fire safety field say that 90% of all fires can be prevented or controlled with negligible damage—*if* proper fire safety precautions are taken and *if* knowledge of the proper use of approved fire control equipment becomes more widespread.

Welding, as statistics show, is not a leading cause of fire in industry. But it has caused enough damage to

USE SHEET-METAL guards, asbestos paper or such if neither the work nor flammable materials can be moved

PAN HOLDS sand or water to extinguish sparks or burning slag. Metal guard protects the weldor's legs

Fires if—



DON'T INCREASE cutting-oxygen pressure to see how far the sparks can fly. This chart tells you. Correct pressure is safest and most economical*

class improper and careless use of welding apparatus as a serious fire hazard. Fire hazards may occur in the use of all methods of welding—both gas and arc—and in flame-cutting. Welding and cutting in most industries are special operations and should be treated as such.

It's up to management to see that employees comply with recognized precautions and that approved fire extinguishers are on hand during cutting and welding operations. Since most welding fires start because of human carelessness, it is clear that greater emphasis must be placed on safety rules.

Fires from Special Jobs

The majority of fires caused by welding occur in the use of portable equipment. Fires seldom occur where equipment is set up for production work since reliable safeguards can be built into the set-up. Many times the equipment is in the hands of an outside contractor doing repair work or in the hands of an inside repair crew that has not been properly alerted to the fire hazard.

Where an open flame could constitute a danger, as in or near rooms containing flammable vapors or liquids or exposed loose combustible material, it's not wise to perform cutting or welding work. If the work can be moved, it is preferable to take it to a safe area. Where welding must be done in the vicinty of combustibles, sweep floors clean and if they are not of a fire-resistive material wet them down before starting work. Wooden floors can be covered with sheet metal in areas where sparks or hot metal are likely to fall. Metal screens or asbestos curtains can be used to contain the welding operation.

There are two other necessary precautions when welding is done close to a wooden construction or other combustible material: (1) have an adequate supply of approved extinguishers handy for an emergency and (2) keep a man at the scene for at least half an hour after completion of the job to make sure that smoldering fires haven't started.

While accidents due to welding on containers are not frequent, they are likely to be severe if they do occur. All flammable vapors, liquids or solids should be wholly removed from a container before welding operations are commenced; the International Acetylene Association can tell you what should be done in this regard.

Equipment and Clothing

Welding and cutting equipment must be kept in good operating condition. Soapy water is recommended in testing for leaks. Weldors' clothing should also be kept in good condition at all times. Woolen clothing is preferable to cotton because it is not so easily ignited.

Weldor's clothing should be free of oil or grease. Outer clothing should have no open pockets and cuffs since sparks may lodge in them. Protective hats and high safety shoes are a must.

The man wearing goggles or welding helmet may not be able to see a small fire when it starts. Hence it's wise to have another man on hand to watch for such dangers. This means that welding shouldn't be done

*Photos and drawing courtesy of The Linde Air Products Co.

after regular working hours by a one-man crew.

Many industrial plants have organized their own employee fire brigades. Employees are assigned specific duties and are familiarized with various types of Underwriters' approved extinguishers and how to use them. This is especially important because different types of extinguishers are suitable for different types of fires.

Determine the "risk" areas in your plant and install the extinguisher that will do the best job for that area.

The A-B-C's of Fires

In this modern age, a lot of information may be packed away behind two or three letters of the alphabet. Even fires have their A-B-C's, and it pays to know them if you want to use the right type of fire extinguisher. Failure to use the proper extinguisher may prove disastrous when you are fighting a fire. Learn the classification below by heart:

Class A fires are of wood, paper, cloth, rubbish and similar combustible materials. Use approved foam or soda acid extinguishers. "Approved" means that the extinguisher bears the label of the Underwriters' Laboratories or the Factory Mutual Laboratories.

Class B fires are of oil, grease, paint, etc. Use foam, dry chemical, vaporizing liquid or carbon dioxide extinguishers, approved of course. Don't throw water on this type of fire—you'll spread the flames!

Class C fires are in electrical installations, including motors and generators. Again, don't use water or "water type" extinguishers. Use carbon dioxide, dry chemical or vaporizing liquid extinguishers.

If your extinguishers are kept in good shape at all times, employees will be able to cope with fire when it strikes—if it does strike.

As evidence of what fire protective measures can accomplish, we submit an interesting report appearing in a recent issue of the IAA *News Bulletin* (Oct., 1950). To cope with the large volumes of flammables that must be handled, a manufacturer of synthetic organic materials has a well organized and well administered safety and fire prevention program. An average of 40 men have worked full-time on welding and cutting at this plant during the past eight years. During this period, each full-time operator was responsible for only one fire in five years. Even more important, all of the fires were extinguished in their very early stages—the average loss per fire was only about $19. This plant, which works every day with materials of a hazardous nature, has not had a single "insurance loss" from welding and cutting fires in the past twelve years.

This experience clearly shows: (1) how the frequency of fires in high-hazard manufacturing plants can be minimized and (2) how a proper safety program will prevent fires from developing into high loss.

In times like these, the destruction of vital materials and the loss of equally vital manpower through fire is a luxury our nation simply can't afford.

Plugs instead of Clubs

No. 9 in a series of inspirational talks on "Twelve Self-Assignments to Sales Success"

BY RICHARD C. BORDEN

WHENEVER your customer expresses interest in a competitive product, make that your cue to talk your own points of difference UP . . . instead of talking the other fellow's points of difference DOWN. Make it your cue to "plug" instead of "club."

To appreciate why that's good policy, think back to the days when you were a boy and used to heave clubs at apple trees when no one was looking.

If that picture from the past comes back to you clearly enough, you may remember this significant detail of it:

The most clubs always tended to pile up beneath the best trees.

Your customer, being a smart cookie, has learned to apply that same cause-and-effect principle to the forming of his purchasing judgments, learned that selling time spent clubbing a competitive product is usually in direct proportion to the salesman's respect for that product and his FEAR of it.

So you risk weakening, rather than strengthening your case, when you handle a competitive situation like this:

"I'm surprised that a smart buyer like you would even consider such an outfit! I could stay here all day telling you what's wrong with them."

That's not the way a skillful salesman operates. When he hears a customer express interest in a competitive product, he handles the issue like this:

"Yes, that unit's a good one, but certain features of our own product make it a better buy. Let me tell you about them!"

That's the way to spend your time when you're bucking competition. Spend it plugging your own product instead of clubbing your competitor's.

This month . . . all month . . . apply that strategy to the solving of your own competitive problems.

And don't be afraid to apply it in a spirit of generous concession.

Concede that your customer isn't stark raving mad in his enthusiasm for the other fellow's product. Concede that the other product has several good features . . . has many of them, in fact . . . perhaps even enough to rate 49 counts on a 100-point score sheet as against your 51.

Such concessions, you will discover, only increase your believability when you proceed to plug your own side of the score sheet . . . will help you sell with 51% just as surely and vigorously as if your margin of competitive superiority were overwhelming.

Make no exception to the application of that strategy this month. If you do, each reversal of that strategy will mean you are cutting off your own nose . . . in order to spite your competitor's face!

These articles, published every month in THE WELDING ENGINEER, *are based on the script of a Dartnell-Borden series of sales films, "Selling against Resistance."*

1—FLASH WELDING of titanium is accompanied by bursts of intense bluish-white sparks as in welding magnesium

Rings from Titanium

Titanium rings for aircraft jet engines were successfully flash-butt welded at the Warren, O., plant of the American Welding and Mfg. Co. Here's the lowdown.

TITANIUM, with a melting point of 3,200 F, is a promising metal for such high-temperature applications as aircraft jet engine components. Fortunately, it seems to be readily weldable.

American Welding and Mfg. Co., Warren, O., has successfully flash-butt welded rings from titanium bar stock with a cross-sectional area of two square inches. The job was done on a production basis, and the sequence of operations followed the same general pattern that American Welding uses for the fabrication of heat-resistant alloy rings for combustion chamber and tail-cone assemblies.

The titanium bars were heated to 1,600 F and formed into rings between rolls. The open end of the ring was then closed by flash welding. The nature of a ring introduces a peculiar electrical problem: a considerable amount of the current is short circuited around the ring and contributes nothing to the actual welding. Since this short circuit current makes up approximately 60 to 80% of the total load, a large consumption of current is necessary.

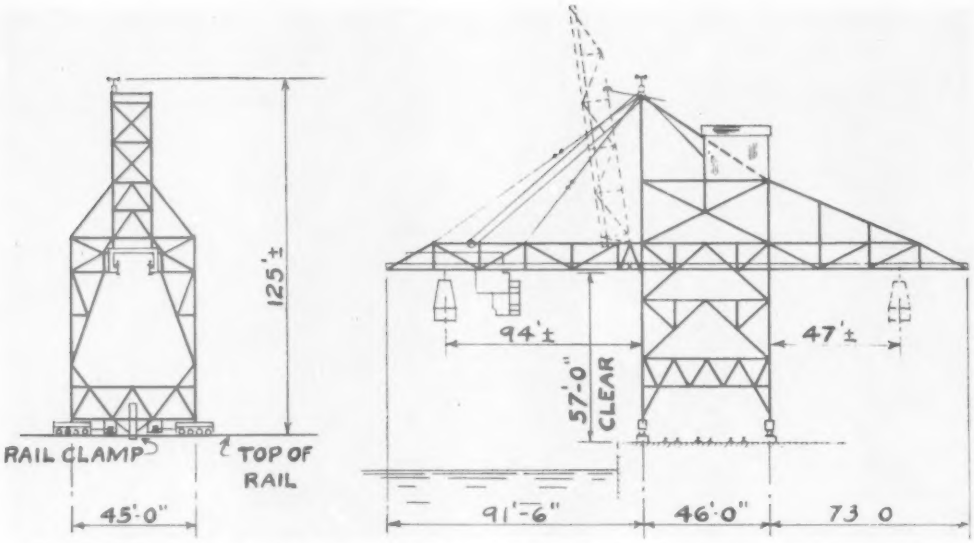
All of the operations required by the fabricating procedure were done by the company's standard production equipment. The flash-butt welding was with a 750-kva welder. Fig. 1, a photo taken at 1/200th of a second, shows that the welding is accompanied by bursts of sparks. The sparks are of an intense bluish-white color, similar to the sparks encountered when magnesium is welded.

After welding, the flash was removed, and the rings were reheated to 1,600 F so that they could be sized on an expander. Heating had to be done rapidly, American Welding found, because titanium readily absorbs oxygen when above 1,000 F.

The welded titanium rings were machined at surface speeds and feeds greatly in excess of those recommended in current published data. The use of carbide tools permitted speeds in excess of 300 fpm and a feed of 0.012 in. per revolution, resulting in an excellent surface finish.

2—180-DEG BEND indicates the ductility of the welded joint and soundness of the flash-butt weld. Test bar was of commercially pure titanium, 1⅝ by 1¼ in. in size

Proof of the soundness of flash-butt welds that can be obtained in commercially pure titanium may be seen in Fig. 2, a close-up of a welded titanium bar given a 180-deg bend turn through the weld joint.



THE PLAN: Sketch shows outline and main dimensions. The whole tower is carried on four eight-wheeled trucks

Iron Ore Unloader

BY W. B. MacLEAN

Crane & Bridge Department, Dravo Corp., Pittsburgh

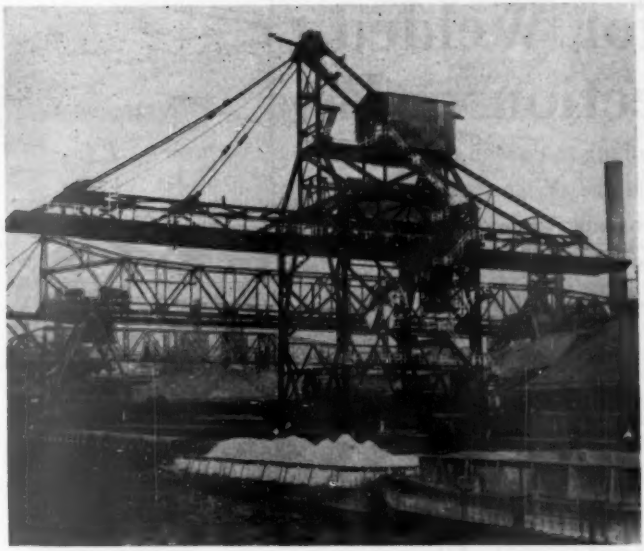
A 15-TON ORE unloader for the east coast, built to fill the need for equipment to handle the increasing importation of iron ore from Liberia and South America, features the combined use of welded and riveted construction.

Because of the corrosive influences of salt water and salt air in seaboard areas, seal welding that completely protects the joints is most effective, but laboratory tests have shown fillet-welded members to have low fatigue value where subject to serious stress fluctuations or reversals. That is why it was decided to employ riveted construction for the runway portion of the unloader, parts of which may receive 20 to 30 million stress cycles during service life.

The tower of the unloader was welded as it is not subjected to stress fluctuations from live loads as great as those in the runway. The center tower section stands approximately 125 ft high, while the horizontal run-

TROLLEY frame is of heavy welded steel to support drive mechanism, control boards and hoist for bucket

WELDED STEEL DRUM for lifting the runway apron. The drum has been grooved to receive rope in one layer



THE PRODUCT: Tower carries trolley runway; trolley carries ore bucket

Design Speeds

Speeds of the several motions are:

Tower travel: 90 ft per minute.
Trolley travel: 1,200 fpm, balanced speed.
Bucket hoist: 250 ft per minute.
Turntable: 9 rpm.
Apron hoist: 7 minutes to hoist.

way extends 94 ft over the harbor area to give the bucket access to ships' holds. The rear or cantilever part extends 47 ft over the ore storage area. Total weight of the unloader with the bucket empty is 646 tons, and the weight of the moving trolley is 94 tons. Normal capacity of the bucket is 15 net tons of ore weighing 150 lb per cu ft (iron ore).

Tower Runs on Tracks

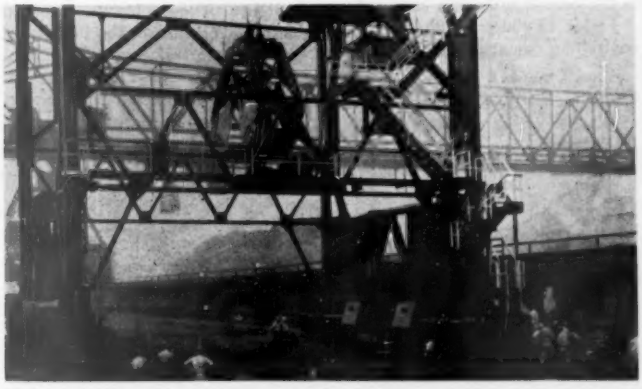
The unloader travels on two double rail tracks spaced 46 ft center to center and is carried on four eight-wheel trucks, one at each corner of the tower. All eight wheels at each corner are driven by a 45-hp motor.

Between the 46-ft tracks there are three standard-gage railroad tracks. The lower portion of the tower is constructed in the form of a portal to clear ore trains and other rolling equipment on these tracks.

As a safety feature against wind storms, two automatic self-aligning rail clamps are mounted at the center of the sill structure. These can hold the unloader against a wind of 106 miles an hour (45 lb per sq ft) without the brakes on the drive motors.

The all-welded tower structure is built entirely of rolled steel shapes. No lacing is used. Splices in main columns are butt welded wherever possible, and bracing members generally are fillet welded to gusset plates. All main connections were seal welded to prevent corrosion at the faying surfaces.

The trolley runway consists of two modified Warren trusses 9 ft 9 in. deep and 13 ft 7 in. center to center; the main members are of 18-in. Mayari-R steel.



FOOT OF TOWER, showing transfer from rollers to permanent dock rails. Truck rails are on 46-ft centers. Note how tower will travel along dock

Apron Lifts up

The apron is hinged at its inner end and suspended on two sets of linked eyebars so it can be raised by hoist to clear a ship's rigging while moving along the dock. The apron is similar in construction to the fixed position of the runway. When raised, it is held securely against movement in either direction by a structural steel latch at the top of the tower.

The hoist for raising and lowering the apron is on the top of the tower. It is operated by an electric motor driving through worm gear and spur gear reductions to a welded steel rope drum. The drum is grooved to receive all of the rope in one layer.

The trolley is a heavy welded steel frame approximately 12 ft wide by 34 ft long. It supports a two-motor hoist for the bucket and two trolley drive mechanisms. Suspended from the trolley is a two-story, all-welded sheet-metal control house. The upper story houses electrical control boards and resistors for hoist and trolley travel, and the lower story is the operator's cab.

The trolley frame was completely fabricated before any machining was performed to provide the best foundation possible for alignment purposes. As a result, it functions as a

(*Continued on page 42*)

Design for Welded Connections—II

If you have anything to do with design, save this article. It tells just what the designer should know about welded fastenings. Economical fabrication requires proper quality control methods as well as good design.

BY T. B. JEFFERSON AND W. J. BROOKING*

The most expensive engineering is that done in the shop. Unless the men who do the welding are provided with blueprints and specifications that eliminate guess work, the cost of welded fabrication goes up.

Even with adequate engineering design, the shop is left with the problem of quality control. How can you make sure that you will always get exactly what the doctor ordered? Again, the engineering department must be called in to suggest methods.

This two-part article by two nationally recognized authorities is on just such questions as are suggested in the above paragraphs. Last month the authors discussed problems of fit-up, weld symbols, internal stresses and their relief, steps to minimize distortion, how to understand the transmission of stresses throughout a welded structure and through welded joints. The present installment takes up such topics as designing to save weld metal, maintenance of close tolerances, material and space economy of welded fastenings, strength of weld metal, effects of external stresses upon weld joints.—THE EDITORS

WELD METAL is expensive. Any design that can develop the strength of weld metal to the best advantage and reduce the quantity used merits important consideration.

Figures 6, 7 and 8 show examples of the use of weld metal in correct and incorrect designs. In Fig. 7, the question as to whether or not the method shown is desirable depends upon the cost of producing the contoured member to which the plate is welded. The machining costs of producing such a piece may be more expensive than the extra welding. There is some question as to whether any saving would be gained in the overall cost of this design.

In Fig. 8, the inserted boss is to be preferred to that shown as "incorrect." The "correct" design requires less weld metal and gives less difficulty in finish boring the hole.

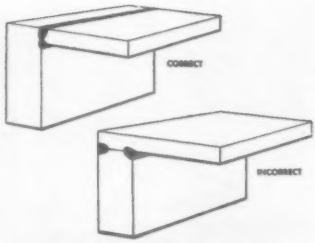
For mass production of welded structures, the resourceful use of forged or special rolled sections as shown in Fig. 9 may provide a real saving in weld metal as well as a superior design from the standpoints of strength and weight. Figure 10 shows a wider variety of shapes that may be forged or even rolled on a commercial basis; some suggested uses for such special sections are included at the side.

MAINTAINING CLOSE TOLERANCES

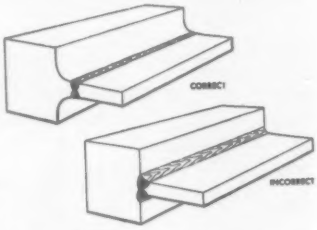
In the manufacture of welded equipment, various parts placed together for welding are sometimes made into substructures and then finally assembled into a finished weldment. Consideration should be given to the relationship of the parts to the overall tolerances required.

Figure 11 illustrates the effects of controlling cumulative tolerances. Of the two designs, one (left) provides flexibility of assembly to maintain tolerances because of the manner in which certain parts lap in their joining. The other (right) is non-flexible because the parts which lapped

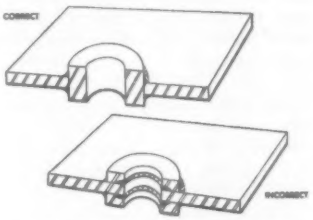
*From Chapter 6 of "Introduction to Mechanical Design," a new book published by The Ronald Press, New York City 10.



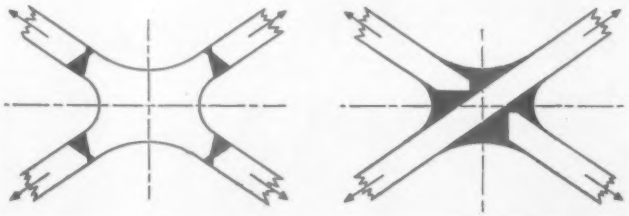
6—MAKE WELD in the lightest of two plates wherever it's possible



7—"CORRECT" drawing shows way to eliminate a reinforced fillet (expensive) and reduce weld metal

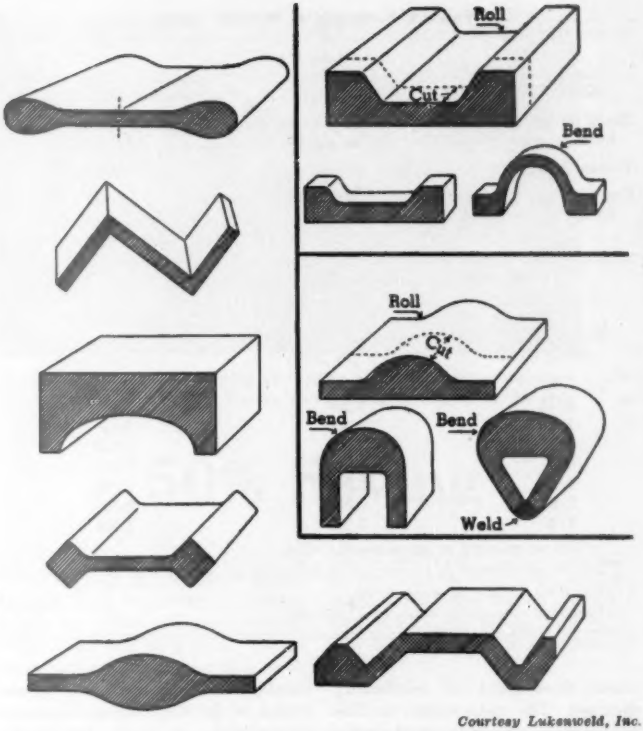


8—INSERTED BOSS takes less weld metal and is preferable to the design labeled as "incorrect"



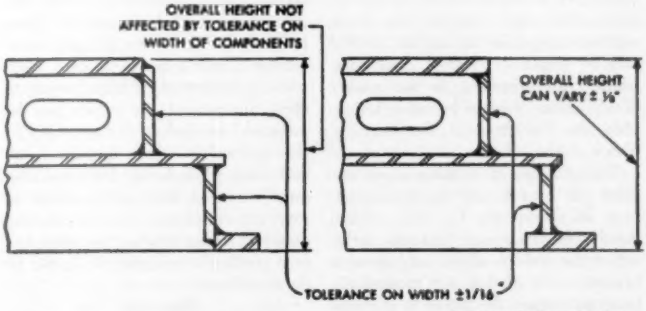
Courtesy Lukenweld, Inc.

9—FORGED intersection piece saves all the weld metal required at right



Courtesy Lukenweld, Inc.

10—SPECIAL ROLLED shapes are available for mass-production weldments



Courtesy Lukenweld, Inc.

11—DESIGN AT LEFT is flexible to maintain tolerances because of the manner in which parts are overlapped. Other design is non-flexible

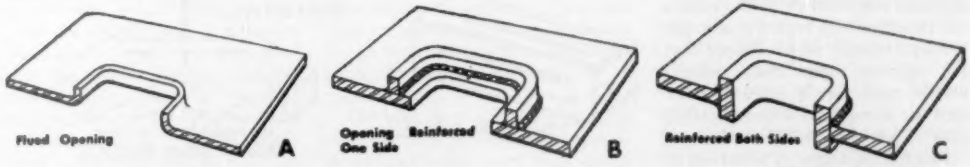
in the previous design are butted as spacers and therefore are inflexible in maintaining tolerances.

Temporary steel clips may be tack welded onto certain heavy structures to hold parts together for welding. The clips allow a small amount of controlled movement of certain parts during welding and are sometimes used in building structures such as Diesel-engine frames. They provide additional elasticity because they give an opportunity for carefully studied sequence of welding. The lapped members for the final joint reduce the residual stresses and consequent distortion. They allow movement of parts due to welded contraction without creating expensive gaps in fit-up, and maintain closer overall tolerances.

Space and Material Economy

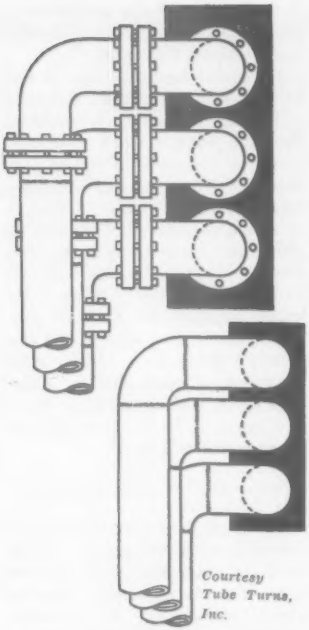
One of the major characteristics of welded design is the economy of material and space that can be obtained by its use. As a means of fastening where permanence is allowable, welded joints provide an economy of both material and space, which savings are often of great advantage.

Figure 13 illustrates the saving in space and weight resulting from the use of welded fittings and piping instead of bolted and flanged fittings. In a certain elbow with 8-in. pipe, the difference in weight and material obtainable by the use of welded instead of bolted flanged fittings exceeds 140 pounds in a specific pipe joint. Much of the weight saving in this particular case is the result of steel being used instead of cast iron, but the economy in both space and material becomes obvious by merely examining the bulk of the fittings and visualizing their installation. The principle illustrated here holds true for brazed tubing as well as for almost any other tube joining where screw fittings may be replaced by a welded installation. It also applies in general to the joining of the parts of all



Courtesy United Welding Co.

12—THREE WAYS of reinforcing openings. Fluod opening shown in "A" is least expensive since it requires no welding



13—FLANGED assembly requires much more space for turns than assembly made with welding fittings

Table I. Strength of Welded Joints

A—Unit Stress

Kind of Stress	Permissible Unit Stress
Shear on section through throat of fillet weld, or on faying surface area of filled plug or slot weld	13,600 psi*
Tension on section through throat of butt weld	16,000 psi**
Compression (crushing) or shear on section through throat of butt weld	Same as allowable stress for base metal

B—Safe Allowable Loads for Fillet Welds in Shear

Size of Fillet Weld, in.	AWS Recommended Values,† Lb per Inch	"Fusion Code" (Structural), AWS, Lb per Inch
1/8	1,200	1,325‡
3/16	1,800	1,985
1/4	2,400	2,650
5/16	3,000	3,310
3/8	3,600	3,975
1/2	4,800	5,300
5/8	6,000	6,620
3/4	7,200	7,950

*15,000 psi allowed as an emergency value.
**24,000 psi allowed as an emergency value during World War II.
†Based on 13,600 psi shear stress.
‡Based on emergency value of 15,000 psi.

structures since welding is fundamentally a joining of edges instead of a joining of overlapping parts by fastening elements which pass through both parts and squeeze or pin them together.

Strength of Weld Metal

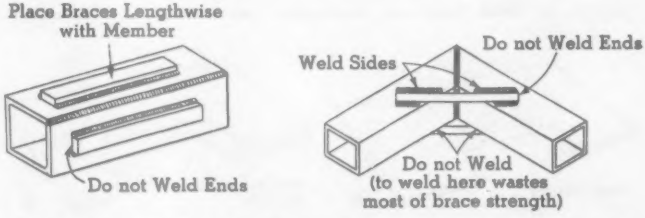
Weld metal may be expected to have a strength exceeding the strength of the plate. In this regard, the ASME Power Boiler Code ascribes a 95% efficiency on fusion-welded joints on power boilers and provides for the calculation of stresses at 1.25 the stress calculation for other types of joints when 0.10 in. has been added to the thickness of the plate. Since the ASME Boiler Code is probably the most rigid and the most conservative of all common specifications with regard to strength, it may normally be considered that, for purposes other than pressure vessels, welds may be expected to exceed the strength of ordinary carbon steel of less than 0.35% carbon.

Reinforcing edges of structures or openings in them may be accomplished by several devices. Figure 12 shows three ways of reinforcing openings. The embossment or "fluing" opening (A) is the least expensive since it requires neither welding nor special material. Each of the other two methods serves a special design purpose. Any of these three methods may also be applied to the outside edges of welded structures where reinforcement is necessary. Welds should seldom be made larger than the thickness of the thinnest plates of the joint.

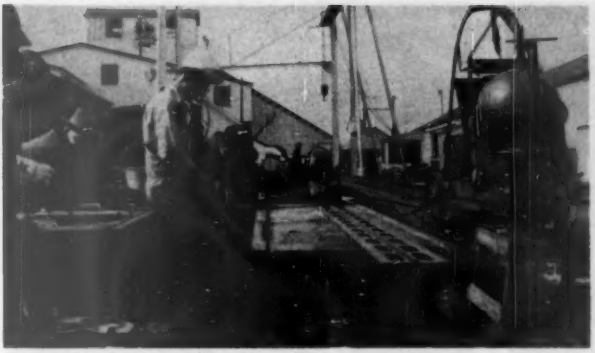
The principle of welding along the sides of braces and reinforcement bars is shown in Fig. 14. Care should be exercised not to weld across the ends or all the way around braces; welds all the way around effectively reduce the brace to a strap equal to the thickness of the penetration of the weld. When this strap section fails, it cracks the whole brace, which also fails.

The American Welding Society's recommended allowable stresses for use in arc-welded design are given in Table I. The values given in tabulations A and B are to be used when welding mild steel. If higher-strength steels are welded, the values may be increased somewhat, but care should be exercised to insure that the localized heat of welding does not materially weaken the joint because of weld embrittlement. If there is any doubt as to the effects of welding upon a particular material, it should be stress relieved.

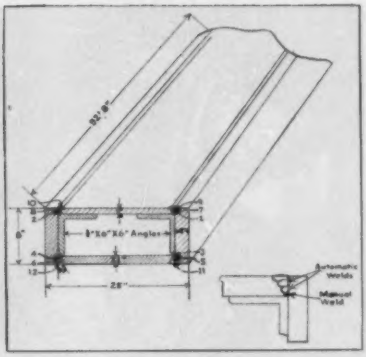
The End


Place Braces Lengthwise with Member
Do not Weld Ends
Weld Sides
Do not Weld Ends
Do not Weld
(to weld here wastes most of brace strength)

14—DON'T WELD all the way around braces since welds across ends will reduce the brace to a strap equal to the penetration of the weld



1—SEMIAUTOMATIC welding gun moves along the joint on carriage of flame-cutting machine. Welder moves along the tracks at the side



2—NUMBERS 1-12 indicate sequence of the passes in the four corner welds

50% Saving

BY BUYING the steel and welding it to make its own dipper sticks, Clemens Coal Co., Pittsburg, Kans., is able to realize savings of around 50% in the cost of a stick. Use of submerged-arc welding makes such savings possible by lowering the welding time from 160 to 16 hours per stick.

Let's look at the fabrication of a dipper stick for a bucket of 14 cu yd capacity. This stick is a box structure 52 ft 8 in. long, 25 in. wide and 8 in. thick.

IT'S DONE OUTDOORS

The company's shop is too small to hold anything of the dimensions of the big stick. Hence the parts were assembled and welded outdoors. Two sticks were fabricated at once to lower the overall welding and assembly time. Alvin Porter, the company's master mechanic in charge of repair and construction, oversaw the arrangements.

First, the two sticks were tack welded to assemble their separate components. A track of two 12-in. channels was laid as shown in Fig. 1, and the welding unit, mounted on a four-wheeled truck, was positioned along the sticks as welding progressed. The nozzle or "welding gun" was clamped to the carriage of a flame-cutting machine, which moved it along the joint to make the long lengthwise welds.

All material is mild steel: 0.22-0.28% carbon and 0.30-0.50% manganese. The two side pieces are 2 in. plates, the top and bottom pieces are 1 in. and 1¼ in. plates. Two ¾ by 6 by 6 in. angles are used as internal bracing.

Single-vee butt welds were put in all four corner joints. The top and bottom plates were beveled to create a 35-deg angle with the side pieces. The components were tacked together by depositing a stringer bead manually in the roof of each joint with a 3/16-in. E-6010 electrode. The joints were then finished with a "high-density" submerged-arc process, making three passes in each joint.

The sketch, Fig. 2, indicates the sequence of the twelve welds. First, one pass was laid in each joint on the up side of the stick. Using two portable winch trucks, the stick was turned over. Passes three and four were put into opposite joints on the new side of the stick. Then pass five was made on top of three and pass six on top of four.

The winch trucks turned the stick back to the first side. Pass seven was laid on top of pass one and pass eight on top of pass two. Pass nine went on top of pass seven and pass ten on top of pass eight. That completed the welding on that side of the stick.

The stick was given a final turn with the winch trucks, and passes eleven and twelve were laid: eleven over five and twelve over six. By following this sequence and keeping the heat input uniform, the dipper sticks are free of the effects of distortion and are finished up straight —the way in which they are first assembled. It should be noted that manually welded dipper sticks are seldom, if ever, straight when all welding has been completed.

"HIGH-DENSITY" WELDING

The "high-density" welding process used owes its name to the fact that extremely high current densities are employed on the welding electrode wire. It is possible to use up to 600 amp on a 5/64-in. diameter wire, which melts the electrode at a rate equivalent to the use of 10,000 amp on a 5/16-in. electrode.

The welding unit is a flexible machine that can be used for automatic or semiautomatic submerged-arc welding and also manual arc welding. In addition to the welder, the equipment includes a reel of electrode wire and an automatic wire-feed mechanism. The wire is fed through a current-carrying cable to a welding gun. The gun consists of a nozzle for the wire at the end of a cone for holding the gravity-fed flux. Wire is automatically fed to the work through a preset arc voltage.

Current was supplied from a 600-amp d-c welder, moved along the tracks at the sides. A welding current of 550 amp was used, permitting a welding speed of 10 ipm. Neither current nor speed were varied once the welding started, which enabled the heat input to be uniform in all joints and avoided distortion.

Photo courtesy The Lincoln Electric Co.

1—PNEUMATIC CHIPPING tool helps prepare edges in repair of a motor frame casting broken in service

2—HAND CHISEL was also used to chip away the defective area and bevel the edges to form a double vee

3—WELDING TECHNIQUE was the same as for mild steel. A 1/8-in. free-machining electrode was selected

4—FINISHED WELD shows the multipass structure. Joint was allowed to cool five minutes between passes

How to Weld
Gray Cast Iron

Of all the materials there are in the world to weld, cast iron is usually considered one of the toughest. It's not easy to make a machinable weld to repair a broken casting, but it can be done, by either the gas or the arc process, if you follow the instructions outlined below.

BY M. J. KELLNER

Superintendent, Trafford Foundry, Westinghouse Electric Corp.

MOST commonly used cast iron is the so-called "gray iron" in which nearly all the carbon not combined is present as small, uniformly distributed flakes of graphite. It is easy to distinguish this material by the dark gray color of the fracture, and you will smudge your finger with the graphite if you rub it across a newly made fracture.

Gray iron is much softer and less brittle than white cast iron. It is readily machinable and may be welded by both the oxyacetylene and arc welding processes.

Oxyacetylene Welding

Chip or flame-cut the defective area to prepare the joint for oxyacetylene welding. Sand and slag inclusions must be removed before welding starts. The welding rod should be an uncoated cast-iron rod free of non-metallic inclusions and low in both phosphorous and sulphur. (For alloy irons, attempt to use a rod of the same or similar composition.)

Use a good grade of cast-iron welding flux. The essential function of a flux is to combine with (or otherwise render harmless) the products of welding that would interfere with the physical properties of the deposited metal or would make welding more difficult.

Small objects (under 25 lb) may be preheated with welding torches. Use a preheating furnace, a gas burner or some other convenient method for larger castings. The casting should be heated to about 800 F within a radius of 12-18 in. from the area to be welded. Hold it at that temperature for at least one hour. For sections 2 in. thick and over, use two or more burners within a radius of about 24 in. from the weld zone.

The welding flame should be either neutral or slightly carburizing. The preferred technique is to deposit the weld in layers not exceeding a thickness of ⅛ in. Flux sparingly—only as warranted by the presence of impurities or to increase the wetting of the deposit.

Immediately on completion of the weld, as much of the casting as is practicable should be covered to prevent sudden chilling of the weld zone. Postheating is also necessary. Postheat to 800 F and cool the casting from the postheat temperature within a period of two to three hours by reducing the flame size in gradual steps. If the section is 2 in. thick or over, use the same techniques but cool the casting from postheat temperature within a period of 10 to 15 hours.

Metal-Arc Welding

Material for arc welding should be prepared by chipping out the defective area free from sand and slag inclusions. In chipping, the angle of bevel should be held as small as possible in order to hold shrinkage stresses to a minimum.

Preheating will not be necessary in most cases. Exceptions are heavier sections, in which the chilling effect of the large mass of adjacent cool metal might produce a thin layer of white iron. Since such white iron would cause machining difficulty, it should be avoided by preheating the heavier casting section within a range of 200 F to 600 F, depending upon the particular job.

A pure-nickel core covered by an extruded coating is the recommended electrode. Either a-c or d-c straight polarity may be used. The amperage will vary in accordance with the position of welding and the size and thickness of the parts being welded. A good rule is to use a small-diameter electrode with the lowest current that will give good fusion.

Make short welds of not more than 2 or 3 in. long. Peen lightly after each bead to relieve stresses. The weld deposit should always be made in two or more layers: subsequent passes have an annealing effect on the preceding passes and thus minimize the formation of a hardened zone of fusion.

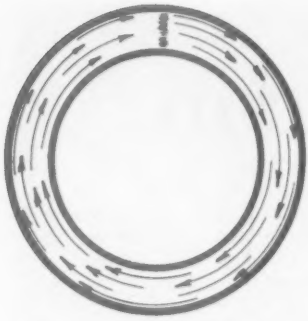
Repair of a Motor Frame

A pictorial example of the techniques discussed above is presented in the accompanying photographs depicting the repair of a motor frame casting that was broken in service.

Both a pneumatic tool (Fig. 1) and a hand chisel (Fig. 2) were used to chip away the defective area and bevel the edges to form a double vee. Trouble was encountered because of the stress due to the previous weld and an occasional sand hole. Not until all the defective area had been removed was the casting ready for welding.

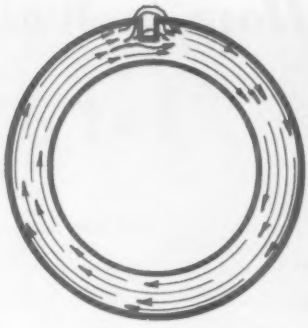
Preheating was not considered necessary on this job. A ⅛-in., 14-in. free-machining electrode for cast iron was used with a current of 150 amp. The welding technique was the same as that used for mild steel. One side at a time was welded, and the joint allowed to cool for five minutes between passes. Each pass was peened during the cooling period. The full length of the defect was welded with each pass.

Fig. 3 shows the welding operation and Fig. 4 the finished weld.



1—MAGNETIC lines of force in a pipe, entirely within the ring

2—CUT CAUSES lines of force to fringe out across the air gap



3—GAP HALFWAY through allows magnetic leakage to the surface

Automatic Inspection

New magnetic-particle equipment inspects seam-welded pipe just after it leaves the welding wheels. Savings may amount to $2,300 in an eight-hour shift.

BY J. E. CLARKE, R. A. PETERSON, T. J. DUNSHEATH*
Magnaflux Corp., Chicago

FAILURE of pipe in the field may be expensive from the standpoints of material lost, damage to surrounding property, shut-down of facilities and the cost of repairs. It's the purpose of this article to describe automatic methods of locating defects in resistance-welded pipe at the time of manufacture. Similar inspection procedures can be applied to resistance-welded tubing. First, however, a few words about the making of pipe.

How a Pipe Mill Operates

The resistance-weld pipe mill is a rapid and economical means of producing line pipe ranging in diameter from about 6 to 26 in. and in wall thickness from ⅛ to ⅜ in. The length of each section is generally 40 to 60 feet.

The manufacturing process begins with a large sheet or "skelp" cut to the approximate finished length of the pipe and with a width equal to its circumference. As the skelp travels down a conveyor, the edges are trimmed and sandblasted. It then enters a series of progressive forming rolls, from which an open tube emerges and is fed to the welder.

A seam-welding process is used. Large beryllium-copper rolls, about 3 ft in diameter and having a 2 in. face shaped to the outer contour of the pipe, make contact on opposite sides of the weld. Current flows between the contact rolls across the weld area to produce the heat for welding. On either side of the tube, directly below the contact rolls, are located the pressure rolls that force the open edges of the tube together. Other pressure rolls are located on a mandrel inside the pipe to resist the squeezing of the outside contact and pressure rolls.

With equipment of this type, welding speeds up to 120 feet per minute can be achieved, using currents up to a quarter of a million amperes.

Emerging from the welder, the pipe is flooded with water, which serves as both a coolant and lubricant while the inside and outside "flashes" are removed by cutting tools. The outside of the weld is left flush with the outer surface, and the inside flash is trimmed down to within about 1/16 in. of the inner wall.

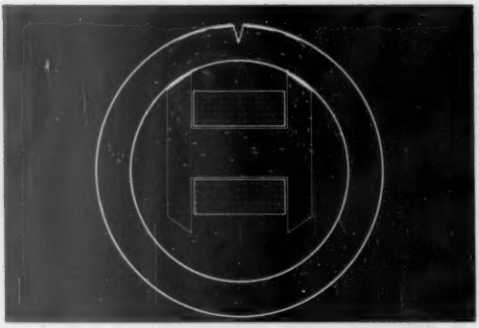
The pipe moves down conveyor rolls to an inspection table, where an inspector examines it visually and marks the points at which the lengths are to be cropped to insure the removal of the unfused weld near the ends. Leaving the inspection table, the pipe passes longitudinally through a series of rollers that straighten and slightly reduce the OD. This operation leaves the pipe with a uniform distribution of internal stresses and improved tensile strength from the cold working. After the ends are cut off, the pipe is hydrostatically tested and then coated for shipment.

Cracks May Occur

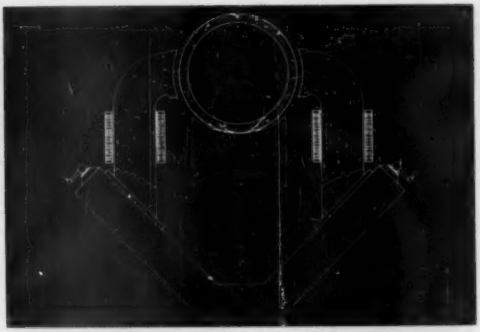
The type of defect most commonly found in a resistance-welded seam is a longitudinal crack. These generally range from 1 to 3 in. long and run in depth to about 10 or 20% of the wall thickness. Cracks as short as ¼ in. and only 0.010 in. deep are sometimes found. Ordinarily, one to six such cracks may exist in each 50 lengths of pipe; more if the welder is out of adjustment or the contact rolls are burned and pitted.

The large cracks may be sufficient to cause a failure or "burst" in the hydrostatic test. Since each length of pipe is worth several hundred dollars, it's well worth while to locate

*Abstract of a paper presented at tenth annual meeting of the Society for Non-Destructive Testing, Chicago, Oct. 24, 1950.

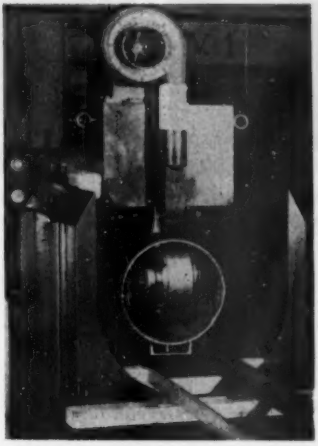


4—INSIDE YOKE schematic. Arrows show path taken by the flux lines. Very little leakage flux can exist

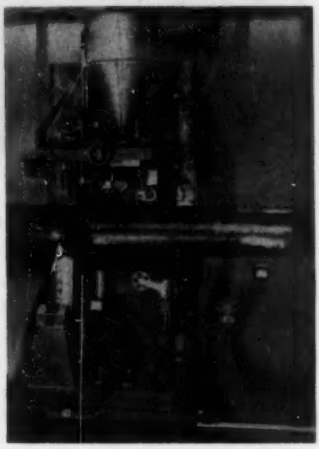


6—OUTSIDE YOKE cross-section. This unit may be located away from the welder, allowing weld to cool

# of Pipe



5—LOOKING INTO end of pipe as it emerges from welder. Yoke is on an extension of welder mandrel



7—OUTSIDE YOKE equipment with a length of 22-in. pipe. Travel of the pipe is from right to left

the cracks and repair them by chipping and rewelding while the pipe is still in the mill.

The desirability of locating these cracks by automatic magnetic-particle inspection was brought to our attention.

Hand techniques of inspection would have had some value as a spot check, but what we were after was something that would not increase the labor cost. In our experimental work, we kept two requirements constantly in mind: (1) inspection must be fast enough to keep up with production line speeds and (2) the equipment should be as nearly automatic in operation as possible.

Before describing the work done or the equipment which resulted from it, let's very briefly describe the principles on which magnetic-particle inspection operates. Figure 1 depicts the cross-section of a pipe or any hollow cylinder. You will notice that the arrows all point in the same direction around a circular path entirely within the confines of the cylinder wall. These arrows represent magnetic lines of force. Since all the lines of force are contained inside the metal ring, there is no surface evidence of the existence of the magnetic field. Now let's make a cut through one side of the ring.

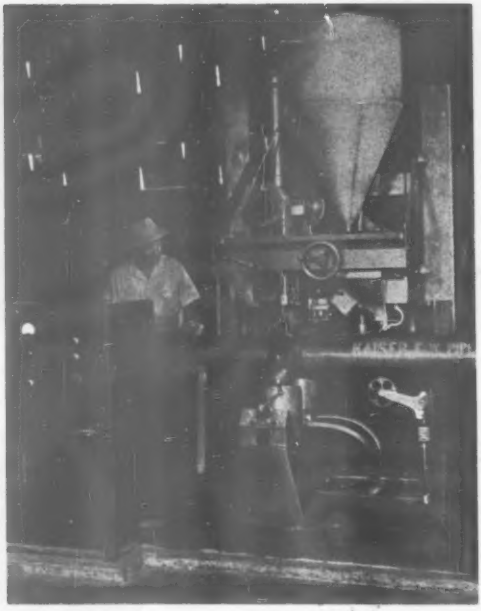
The new condition is as shown in Fig. 2. As the cut is encountered, the lines of force are caused to jump the air gap and fringe out after the manner shown by the dotted lines. This is the condition existing when a crack goes entirely through the wall of a tube. However, few cracks do this so let's look at Fig. 3, where the gap goes about half-way through.

Leakage Field Shows Defect

Here we have a condition midway between the others described. One portion of the magnetic flux traverses the gap area inside the metal as in Fig. 1 while the remainder goes across the air gap and fringes out to form a leakage field external to the ring. The size of the air gap is greatly exaggerated for the sake of illustration; it may be only a thousandth of an inch in width and a few thousandths of an inch deep. Naturally, as the dimensions of the gap decrease the leakage field also decreases, and the difficulty in detecting its presence and location becomes greater.

Most of the devices for determining magnetic leakage fields are unsatisfactory for use in this application. However, there is a sensitive and simple method of locating these tiny leakage fields. A very finely divided powder of magnetic particles is applied over the surface of the part under test. If these particles are fine enough, they will be attracted to the tiny north and south magnetic poles established by the leakage field at opposite sides of the crack. In sound metal, the lines of force re-

8—END VIEW of equipment with indications of defects on the pipe. Inspector marks them with a crayon



9—KAISER STEEL'S new Fontana, Calif., mill has installed inspection equipment of the outside yoke type

main inside the metal so no leakage field exists to attract and hold the powder. In consequence, we may know that the build-up of powder outlines cracks and other defects.

Let us return to the development of equipment for finding the cracks that can be present in the weld seam of resistance-welded pipe. The actual development of suitable automatic equipment was broken down into four basic problems:

(1) The determination of the method of magnetization to be used;

(2) The compounding of a special magnetic powder having desired characteristics;

(3) The development of a suitable means of applying the powder to the pipe; and

(4) Means for removing and recovering the excess.

The magnetic field induced in the pipe must be in the proper direction to produce indications of longitudinal defects in the weld zone; that is, it must be transverse to the direction of the weld, and must cross the weld zone. The magnetizing force must produce a leakage field of sufficient intensity to hold powder to the pipe at the crack. However, it must not be so strong as to cause powder to cling to the surface of the pipe in strings or bands, obscuring indications of real defects.

Internal Yoke on Mandrel

An early method was to use an internal yoke carrying direct current. This yoke, shown schematically in Fig. 4, consists of a bobbinlike magnetic core surrounded by a magnetizing coil. The circular ends of the yoke rotate as they are in actual contact with the inner pipe surface. Arrows show the path taken by the flux lines. Very little leakage flux exists outside the pipe to cause powder to cling where it is not wanted. As a result, defects are shown by clean, sharp powder indications without objectionable background.

A unit incorporating the features needed for inspection consists of a power supply, a set of yokes with extension mandrels, a cyclone separator and a powder applicator and blow-off assembly. Figure 5, a photo looking into the end of a unit, shows the location of the yoke, powder collector hopper and blow-off assembly.

The yoke is mounted on an extension of the welder mandrel. As the pipe comes from the welder, it actuates a switch, which controls the flow of powder from the hopper and also energizes the yoke. A uniform band of powder is automatically applied to the weld zone. The pipe carries the powder to the magnetizing station, where a jetlike stream of air from the blower impinges on the powder and removes all of it except that portion held magnetically at the defect. The powder blown away is collected in a hopper and drawn by suction to a cyclone separator to be reclaimed for further use.

In Fig. 5, the end of the pipe is just emerging from the welder to pass on toward the inspection station. The inspector notes any line of powder appearing on the weld zone and marks it with a crayon or chalk. Further down the line, the defective welds are chipped out and repaired.

The inspector also notifies the welding operator of defects that occur at frequent intervals. The operator can then correct the welding operation. Thus the equipment serves a twofold purpose: it is both a non-destructive inspection tool and a quality control device.

The equipment included in the inside yoke unit is easy to operate and

requires little attention once it is set up for a given size of pipe. There is, however, a disadvantage in locating the inspection equipment directly after the welder. The pipe temperature must be below 700 F: above this value the powder particles coalesce on the hot weld surface and form a cinderlike mass that gives no indications of cracks. Since the weld zone and adjacent areas are generally well above 700 F as the pipe leaves the last pull-out stand, a water quench is needed to bring the temperature down to a reasonable value. Air drying of the weld zone is also required because the magnetic powder cannot be used on a wet surface.

Outside Yoke Unit

Water cooling is perfectly satisfactory as long as a low-carbon steel pipe is being welded. However, the trend to higher and higher operating line pressures has increased the demand for a stronger pipe, often of high-carbon or alloy steel. With this material, the water cooling may produce poor grain structure in the weld. During the last two years, the demand for high-strength pipe increased to the point where we felt it necessary to design equipment to be located some distance from the welder in order to allow time for the pipe to cool without the water quench. Since there would be no mandrel inside the pipe at its new location, the inside yoke could not be used for magnetization. Experimental work in our laboratories has led to the development of a magnetizing structure wholly external to the pipe.

Figure 6 shows a cross-section of the magnetizing part of the unit. Direct current flowing through the magnetizing coils produces the magnetic flux. The flux enters the pipe from the pole ends through an air gap and divides; one-half passes through the lower portion and one-half through the upper portion of the pipe. The flux that flows through the upper portion passes transversely through the weld, which is on top, and will therefore indicate the presence of a longitudinal crack.

The air gap, about 1/20 of the pipe diameter, is provided for mechanical clearance so that a slight out-of-roundness or misalignment may be tolerated. The flux spreads or "fringes" around this gap. To prevent it from spreading up to the weld zone, where it would cause powder to adhere and form an undesirable background, the face of the pole piece must not exceed 0.4 of the pipe diameter in its vertical dimension. The vertical dimension must be great enough, however, to provide the air gap with sufficient cross-section so that unduly large magnetizing currents will not be required in the coils. These two requirements are met by providing several sets of interchangeable pole ends of different sizes; this also allows a wide range of pipe diameters to be inspected.

Pipe travels longitudinally through the mill on double conical or "hourglass-shaped" rollers. Naturally, smaller pipes ride much lower than the larger ones. To accomplish both the vertical and horizontal adjustment, the poles are mounted on an inclined plate that slides on an inclined base. The screw handle at the right of the sketch is cranked to cause the assembly to travel on the inclined base, and both horizontal and vertical adjustment are accomplished simultaneously.

Figure 7 shows equipment embodying these principles. The length of pipe in position for inspection has an OD of 22 in. and a 5/16 in. wall. The application and removal of powder is similar to that in the previously described unit, but the blow-off is directed at 45 deg to the axis of the pipe to blow the excess powder into the scoop. This is necessary since hopper-type collectors cannot be used with the outside yoke.

The pipe is traveling from right to left of Fig. 7. In operation, it actuates the limit switch, which energizes the yoke coils and starts the flow of powder. After a short time delay to allow the pipe to enter the yoke, the scoop is lowered so that it rests on the moving pipe. All operations are done automatically as the pipe proceeds through the equipment.

The inspector sits near the left side of the equipment and marks the defects as they pass. In Fig. 8, we see an end view of the equipment, with indications of defects on the pipe. The angular blow-off and the scoop are both clearly shown.

Figure 9 shows the outside-yoke equipment installed in the newly completed pipe mill of the Kaiser Steel Co. at Fontana, Calif. Through the coöperation of Robert Riegel, Kaiser mill superintendent, we are able to include this photo. The mill has not been in operation long enough to give meaningful production figures; however, the same type of equipment has been in operation for over 1½ years at an eastern pipe mill, and it is possible to predict some of the benefits that may be expected.

Material cost and time remain nearly constant, regardless of pipe diameter or wall thickness. Material cost is quite low and amounts to little more than the cost of the lost powder. Power consumption is about 1,500 watts, little more than most household appliances.

Labor cost can generally be disregarded. With few exceptions, the operator of the machine will be taken from another inspection job that is no longer necessary.

As an example of potential savings, we might consider medium-to-large pipe being run at about 80 fpm. Allowing 20% down-time for roll changing and the like, 614 lengths of 50-ft pipe will be made in an 8-hour shift. Out of each 50, from 1 to 6 lengths will have cracks. If the average number is 3 per 50, we can expect 36 lengths to have cracks. Assuming one out of three of these cracks is serious enough to cause rejection on the hydrostatic test, 12 lengths could be saved by repairing the cracks as they are found by magnetic-particle inspection. Since each length of pipe may be worth as much as $200, this would mean $2,400 saved per shift.

To carry out the test, 500 lb of powder would have been applied during the course of the day, 90% of which would have been recovered. About $50 worth of powder would be actually used up. Adding cost of current and incidentals, a gross saving of over $2,300 per shift could be effected in normal operation. At times when real trouble is encountered, the savings would increase tremendously. Even with the cost of chipping and rewelding deducted, the savings are of such magnitude that the entire cost of the equipment can be written off in a short time.

Photoelectric Scanning

Before closing, there is another development worthy of mention, in connection with welded pipe inspection. This is a photoelectric scanning de-

vice to relieve the operator of the burden of watching the pipe continuously and marking the defects by hand. This development has been operated successfully at the Magnaflux plant, and while none are in actual field operation as yet, tests seem to indicate that it is completely accurate and dependable.

Without going into detail, an optical system throws an image of the passing weld onto the target of a photoelectric cell. Before it strikes the cell, the image is broken up into a flying spot that progressively covers the entire image in about the same way that a television image is broken down and reconstructed. Let the flying spot encounter a change of color due to an accumulation of powder, and a signal is generated. The signal passes through proper electronic equipment and is able to operate the solenoid value controlling a paint spray gun. Either a spot or a line of paint is sprayed to the pipe to indicate the extent and location of the crack. The paint streaks tell the repair men exactly where to chip and reweld.

Ends Visual Fatigue

The use of this scanning device will permit more rapid inspection of pipe welds than is possible with visual inspection and hand marking. There should also be a noticeable increase in the percentage of indications marked. A visual inspector fatigues rather quickly and may miss a percentage of defects even though powder indications have been built up on them. With the scanner, the fatigue problem will no longer be present and there will be no lapses in inspection.

In conclusion, magnetic-particle inspection methods and equipment can be used directly in the production lines to greatly improve the quality and serviceability of the finished piping. Scrap loss can be reduced sufficiently so that the equipment will pay for itself in a relatively short time. By means of this equipment and auxiliary automatic devices, it may be possible to increase speeds to the point where manual inspection is no longer efficient. Since the need for all tubular products seems to be increasing steadily, this equipment should help manufacturers meet the demand for more and better pipes.

IRON ORE UNLOADER

(*Continued from page 31*)

large bed plate for mechanical equipment. The frame is spring-mounted on four single-flanged wheels.

The 125-hp trolley drive motors are mounted on welded steel cradles. The cradles are fastened to two points on the axle through anti-friction bearings and to a third point on the trolley frame through a flexible connection.

Besides the main digging bucket of 15-ton capacity, the trolley is arranged for a 7½-ton bucket, used in small hatches and clean-up work. A motor-driven turntable, incorporated in the trolley frame, lets the operator rotate the smaller bucket to suit digging conditions.

The 250-hp hoist motors each drive a welded steel grooved drum.

Fabrication and Erection

Each apron truss was shop-assembled and shipped in one piece. The fixed runway trusses were shipped in two pieces each. The corresponding length of rail stringer was included as part of the truss assembly. The tower structure was shipped virtually knocked down. The bracing trusses used near the bottom of the tower were within railroad clearances and could be shipped assembled.

Since the runway on which this unloader runs (not to be confused with the previously described trolley runway) is used by other unloaders and by several ore bridges, erecting the new unloader without interfering with the operation of the other equipment presented a serious problem. It was solved by erecting the unloader in an unused area beyond the end of the dock and off to one side of the runway. After completion, the structure was rolled endwise to the dock runway on especially prepared concrete slabs.

Design capacity of the unloader for free digging is 1,100 net tons per hour of iron ore. This is on an average cycle from ship's hold to storage pile. Working with existing equipment to unload ships bringing foreign ore to the plant, the new unloader helps reduce turnaround time for ore boats. It is a contributing factor in the ever-increasing volume of steel production from foreign ores.

JETTISONABLE FUEL TANK

(*Continued from page 23*)

tabs eliminated the need for separate splice plates. The main bulkhead rings were joined by means of bolted splice plates. The shackle and sway brace bolts were then installed, the former in tension fittings mounted on the web stiffeners with ½-in. bolts. This work was done through the access door openings. Naturally, as much of the plumbing and wiring as possible was installed in the half shell prior to welding.

Sealing and Coating

All rivet and bolt attachments that might cause leakage were given a spray coat of thiokol latex compound prior to assembly. After assembly, all such joints and seams were given an additional spray coating of the same material.

Even though aluminum alloys were anodized and steel alloys cadmium plated, as additional insurance against corrosion the entire interior of the tank was given a final coat of preventative compound. This was not applied until after the thiokol compound had cured for 24 hours. The access doors were sealed by means of Buna-N type gaskets.

A special jig (Fig. 9) was devised for the necessary vibration and slosh tests, which were performed in accordance with tank Specification AN-V-7. The tank met or exceeded the requirements for all conditions.

Perhaps an undue amount of coördination went into the development of this tank. Yet without the full attention of the many specialists involved, a good job of production engineering would not have been realized. Attention to detail is of primary importance and has a lasting effect on cost and time. This attention and development for production can be accomplished without sacrificing the requirements of design; in fact, only by these methods can satisfactory discharge of the design function be assured.

* * *

Acknowledgement is made to L. H. Ferrish and Fred C. Hoffman, manufacturing research engineers; Mark Meinel and F. C. Pipher, methods engineers, Lockheed Aircraft Corp., for the aid they gave to the writer in preparing this article.

Invincible Flux Recovery Unit installed directly above welding machine. Salvaged flux is automatically fed back into hopper of welding head.

Save 3 Ways with INVINCIBLE *Flux Recovery Units*

On thousands of submerged arc welding jobs, Invincible units have quickly repaid their costs by:—

1. ***Saving*** **Valuable Flux** — Invincibles recover all loose flux from the work, remove slag or fused particles, and return the unfused flux to the hopper of the welder. These operations are performed in a continuous flow.

2. ***Saving*** **Costly Man-Hours**—Invincibles do the whole job *automatically*—far more rapidly and efficiently than manual methods.

3. ***Saving*** **Expense of Rejects**—By removing all fine dust (flux flour), Invincibles reduce welding rejects and speed production.

These savings can be made on any submerged arc welding job because there is a size and type of Invincible Flux Recovery Unit to meet every requirement.

FREE Folder on Flux Recovery
Illustrated case histories show how Invincibles save money on all kinds of installations. *Send for your copy NOW!*

INVINCIBLE VACUUM CLEANER MFG. CO.
DOVER, OHIO
FOR 40 YEARS, LEADERS IN INDUSTRIAL VACUUM EQUIPMENT

New products

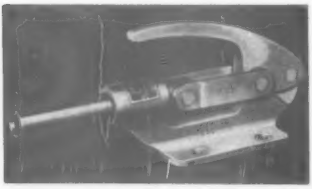
Argon Metal Arc Welds 1½-In. Aluminum

A NEW hand torch and automatic wire-feed unit offered for argon metal-arc welding can weld aluminum ranging from ⅛ in. thick to 1½ in. In this process, the consumable electrode serves as filler metal—it is fed into an argon-protected atmosphere at a predetermined rate. The FSM-2 rod-feed unit automatically controls rod feed, argon flow and cooling water. An electronic governor closely monitors the rod feed at rates varying from 30 to 380 ipm. Pistol shape of the FSH-4 torch helps reduce operator fatigue and provide a better control of the arc.

Besides aluminum, several copper alloys and stainless steel may be welded with this apparatus.

THE LINDE AIR PRODUCTS CO., 30 East 42nd St., New York City 17.

* * *



Clamp Holds Work with 4,000-Psi Pressure

PLUNGER-TYPE toggle clamp added to the "De-Sta-Co" line of work-holding tools will lock in place with a toggle action to deliver holding pressures up to 4,000 psi. Plunger travels 3 in. Base and plunger are in one piece. For rust resistance and non-slip grip, all castings are black crackle finished. Overall dimensions are 3 in. wide, 4½ in. high and 11½ in. long. Weight is 5 lb 10 oz.

DETROIT STAMPING CO., 372 Midland Ave., Detroit 3.

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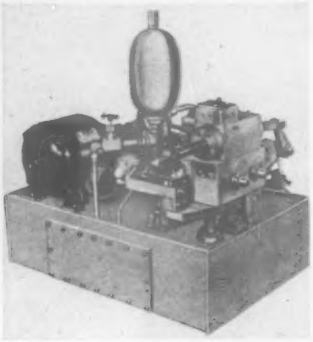


Hydraulic Control Converts Mechanical Flash Welders

MECHANICALLY driven flash welders can be converted to hydraulic operation with the "Hydra-Flash" control. This device can be fitted to any flash welder up to 500 kva capacity. Adjustments are calibrated to make duplication of set-ups easy.

Range of cross-sectional areas that a flash welder can accommodate is greatly extended by the "Hydra-Flash" control. It may be as much as 40 to 1, says the manufacturer. A single limit switch is the only one necessary to operate the welder. Manufacturer claims the control will operate for several million cycles without any attention other than regular lubrication.

KINGSLEY A. DOUTT, 18465 Schaefer Highway, Detroit 35.

* * *

Small Power Shear Cuts 16-Ga. Steel

THE NEW variable speed Di-Acro power shear comes in 12 and 24-in. sizes and has a cutting capacity to handle 16 gauge sheet steel. Its speed range is 30 to 200 rpm. The necessity of engaging the clutch for each cutting stroke has been eliminated.

For single-stroke operation, there is a non-repeating positive safety clutch. Speed of the shearing stroke for both continuous and single cycle operation is controlled by a handle at the operator's left.

Materials the "Vari-O-Speed" Powershear will cut include plastics, fibre, mica, leather, rubber, aluminum, cobalt steel, chrome moly, leaded brass.

O'NEIL-IRWIN MFG. CO., Lake City, Minn.

Special Transformer Cores Featured in A-C Welders

THE new Series 80 Marquette a-c welders come in 200, 300 and 400 amp capacities. Their "Hipersil" steel transformer cores are said to provide a third greater flux-carrying capacity, reducing power consumption and operating costs.

Range of the 200 amp model extends over 40 to 250 amp, the 300 amp size (Model 81C) from 60 to 375 amp and the 400 amp size (Model 82C) from 80 to 500 amp.

For easy striking of the welding arc, the new welder includes double capacitors, one on the secondary as well as primary sides. Operating power factor of this series is said to be over 80%. There is also a leading power factor on the idling position.

MARQUETTE MFG. CO., 307 East Hennepin Ave., Minneapolis 14.

* * *

Sleeve Adjusts Flow on New Control Valves

AN adjustment sleeve provides micrometer adjustment of flow on a new line of "Flo-Set" speed control valves for air, water and oil. These valves can be used at maximum pressures of 250 psi and at temperatures up to 250 F.

Sleeve graduations are in hundredths of a revolution, with each hundredth representing 1/100 of the pipe area. Face of one end is marked "Controlled flow out—Free flow in" and the other end face is marked "Controlled flow in —Free flow out." Free flow is unrestricted flow through an orifice equal to the pipe area.

Metal parts are made of aluminum except for stainless-steel springs.

HANNA ENGINEERING WORKS, 1765 Elston Ave., Chicago 22.

for welding

New automatic inert-arc metal-arc process and a new a-c welder are leaders in February New Products. Take a look at a converter for mechanical flash welders and a new direct-reading argon flowmeter

Flowmeter-Regulator for Argon Welding

DIRECT-READING combination regulator and flowmeter Model R-502 measures argon flow in inert-gas-shielded welding. Its three-stage regulator maintains constant inlet pressure and accurate flow. Second stage is preset at the factory to deliver argon at a constant pressure of 20 psi. A finger-tip control adjusting valve permits accurate, steady flow rates up to 60 cu ft per hour.

The rate of flow is indicated on a new float-type flowmeter calibrated in cu ft per hour. The reading is said to be accurate because the flowmeter is not affected by back pressure from the equipment side.

Same design features are available for a helium regulator-flowmeter, the R-503. Flowmeters of both regulators-flowmeters are available separately. The L-23, argon flowmeter, can be used with a standard oxygen regulator. The L-28, helium flowmeter, may be used with the R-67 hydrogen regulator. The L-28 is calibrated for helium flow in cu ft per hour and will measure flows up to 175 cu ft per hour.

THE LINDE AIR PRODUCTS CO., 30 East 42nd St., New York City 17.

* * *

More Welding Fluxes Made by Eutectic

AN EXPANDING line of welding fluxes is being produced by Eutectic. Called the "Lo-Cost Flotectic Fluxes," they include "Flotectic Flux 1100" for use with silver solder. This flux is said to allow use of smaller amounts of solder for a substantial savings in cost.

EUTECTIC WELDING ALLOYS CORP., 40 Worth St., New York City 13.

* * *

New Silicone Tissue Cleans Weldor's Goggles

"MAGIC LENS TISSUE," a new silicone-treated tissue for cleaning welding goggles, plates and prescription glasses comes in a large size and in a handy dispenser. Recommended not only for factory and office workers, they should prove useful in laboratories, engineering and draftsmen's offices. The silicones are a General Electric product.

Two features boosting the new tissue are its large size and the low-cost, easily-filled dispenser. Interfolded tissues are sold in sealed packages.

THE SILICONE PAPER COMPANY OF AMERICA, 230 Park Avenue, New York City 17.

* * *

Plastic Welding Lens Said to Last 125 Days

NEW "Duralite" plastic cover lenses are claimed to last up to 125 days under ordinary welding conditions. In addition, they are said to completely repel sparks, the main cause of pitting. They resist heat up to 300 F, do not discolor and do not distort light passing through them, declares manufacturer. Made in sizes to fit all helmets and goggles.

AMERICAN INDUSTRIAL SAFETY EQUIPMENT CO., 3300 Lakeside Ave., Cleveland 14.

LEATHER WELDOR'S COAT is 26 in. long. Made of soft chrome tanned split cowhide, it is generously cut at armpits for comfort. Sleeve fronts are double thickness. Other features are double stitching, snap fasteners, adjustable wrist snaps, seam end reinforcement with copper rivets. Sizes are small, medium, large and extra large. Metal & Thermit Corp., 100 East 42nd St., New York City 17.

Safety Goggles Show Extensive Redesign

Two revised and improved series of safety goggles are the 7000 and 3081 series. These goggles have rigid saddle bridges and reinforcing bars. The 7000 series goggles have temples of brown tubing that doesn't discolor and is said to outlast the life of the temple. Eyewires are flat instead of round. Outstanding feature of the new goggle is instant replaceability of lenses without removing side shields.

Soft leather guards cover the bridge and reinforcing bar of series 3081 goggles. Side shields are also of leather and are permanently attached to the eyewire.

AMERICAN OPTICAL CO., Southbridge, MASS.

Two-Colored Fused Lenses for Welding, Scarfing

NEW bi-colored fused lenses are designed to protect the eyes of workers who do welding, scarfing, charge open-hearth furnaces or work at heat-treating jobs. Chief advantage is that they can be replaced quicker and easier than the older two-piece, two-colored lenses.

Strength is assured by making the lens from AO "Super Armorplate" glass, beveled to fit spectacle goggles or cup-type goggles. The following combinations are available: cobalt-clear; "Noviweld"-clear; "Calobar"-clear and "Noviweld"-"Calobar" in half and half combinations.

AMERICAN OPTICAL CO., Southbridge, Mass.

* * *

New "Mash" Welder Made by Sciaky Bros.

FOR JOINING sheets in a clean joint without overlap or protruding metal, the new Sciaky PMM2TL "mash" weldor is said to eliminate grinding or machining to finish the weld. This model was designed and built to join a 28-in. width of mild steel sheet to form a continuous line for mill operations.

"Mash" welding differs from seam welding in that the amount of overlap is limited to only 1½ times the thickness of the sheet. Welding pressure is double that in seam welding, though. Under these two conditions, the plastic edges of the two sheets are forced into a single thickness only slightly thicker than the parent sheet.

Incorporating the Sciaky "Three-Phase" system of welding, the PMM2TL is equipped with a locating and clamping table to locate the sheets to the proper overlap and to hold them securely. After the welding operation, two steel idling wheels perform a rolling operation that reduces the overlap of the two sheets to a minimum thickness. In operation, the operator only inserts the ends of the sheet between electromagnetic clamping bars and presses a control button to initiate the clamping and welding operations.

SCIAKY BROS., INC., 4915 West 67th St., Chicago 38.

Swiss Spot Welder Welds 2-In. Thickness

A NEW resistance welder made by Brown, Boveri & Cie, Ltd., Baden, Switzerland, is claimed to be one of the biggest in existence. Manufacturers claim that a total sheet thickness of 1.91 in. (50 mm) can be faultlessly welded.

A combined spot and seam welding machine, it is controlled by electronic timers. Its pressure system is pneumatic and is said to be very quick-acting. Light metal sheets and plates up to 0.24 in. thick can be spot-welded. Seam welding capacity is two thicknesses of 0.079 in. metal.

The electronic controls provide for preheat, tempering, rough-pressing and after-pressing in spot welding operations. Some other data on the machine is as follows: electric output up to 1,000 kva; normal throat depth of 59 in., extensible to 67 in.; maximum electrode force 6,630 lb.

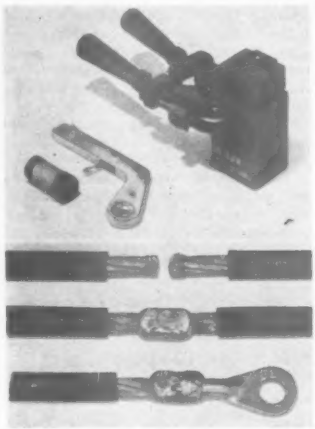
—McGraw-Hill World News

* * *

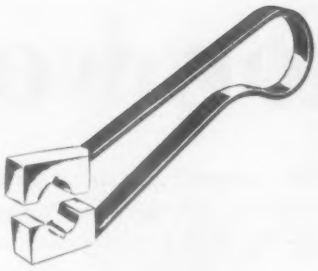
6-in. Cleaner-Polisher Also Grinds, Brushes

A HIGHLY versatile 6-in. cleaner-polisher weighs only 4¼ lb. It does sanding, drilling in metal or wood, portable grinding and wire brushing, buffing, rubbing and cleaning. The swivel side-handle can be positioned for greatest handling convenience. Speed at no-load is 1,300 rpm.

CUMMINS PORTABLE TOOLS, DIVISION OF CUMMINS BUSINESS MACHINES CORP., 4740 Ravenswood Ave., Chicago 40.



WELDING CABLE REPAIRED by the new "Cadweld" process takes just 10 seconds. Mixture of powdered copper oxide and aluminum is ignited in crucible (top). Resulting reaction causes molten copper to flow over cleaned cable ends in graphite mold. Erico Products, Inc., 2070 East 61st Place, Cleveland 3.



Crimping Tool Aids Welding Hose Repair

THE NEW E-Z Way hose ferrule crimping tool speeds attachment of hose couplings up to the rate of 1 per minute. Here's how it works: First, slip a proper size ferrule over the hose end; second, insert hose mender tube or coupling; third, place ferrule in crimping die and strike a sharp blow with a hammer. Turn the hose a quarter turn in the die and strike another blow.

The tool uses standard hose ferrules. The die is of high grade cold rolled steel, mounted on an offset handle.

VICTOR EQUIPMENT CO., 844 Folsom St., San Francisco 7.

* * *

NEW PRODUCT BRIEFS

NEW DROP AXLE for engine-driven welders, trailers, etc., reduces the distance between spring center and track line to less than 8 in. This 7129 Series has underslung springs and spot-welded press-fitted solid square beams. *United Mfg. Co.*, 63 West Interstate St., Bedford, O.

* * *

STAINLESS STEEL developing tanks for X-ray darkrooms are easy to clean and last longer. Each tank has 1½ in. of spun-glass between inner and outer shells to prevent sweating and heat transfer. *General Electric X-Ray Corp.*, 4855 Electric Ave., Milwaukee 14.

* * *

COLD GALVANIZING of metals and weld surfaces is claimed for "Zinkrich" compound, which is applied by paint brush, spray gun or cold dip. It is said to leave a coating of 96 parts by weight of chemically pure zinc that adheres directly to the parent metal. *Chase Chemical Corp.*, 40 West 29th St., New York City 1.

* * *

WORK POSITIONING or hoisting heavy metal objects is simple for the "Pul-Lift," a link chain device actuated by pumping a wrench-like handle. It comes in ¾, 1½ and 3 ton capacities. *Philadelphia Div., Yale and Towne Mfg. Co.*, 11000 Roosevelt Blvd., Philadelphia 15.

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Other Plants: New Castle, Del., Denver, Oakland, Cal., Los Angeles, St. Louis. In Canada: Joliette Steel Division, Joliette, Que.

Trade Names of Resistance-Welding Electrode Alloys and RWMA Specifications

RWMA Types	GROUP A: COPPER-BASE ALLOYS					GROUP B: COPPER-TUNGSTEN ALLOYS			
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 10	Class 11	Class 12	Class 13
AMPCO[1]	Ampcoloy 99	Ampcoloy 97	Ampcoloy 95N	Ampcoloy 86-20	Ampcoloy 92	Ampcoloy 3W1	Ampcoloy 3W10	Ampcoloy 3W20	Ampcoloy W100
ELECTROLOY[2]	Electroloy A	Electroloy XX	Electroloy TX	Electroloy B	Electroloy Molin 2	Electroloy 1	Electroloy 10	Electroloy 20	Electroloy 100
MALLORY[3]	Elkaloy A	Mallory 3	Mallory 100	Mallory 73	Elkaloy D	Elkonite 1W3	Elkonite 10W3	Elkonite 20W3	Elkonite 100W
S-M-S[4]	Alloy 101	Alloy 103	Alloy W-5	Alloy W-2	Alloy 116	Elkonite Alloy 1	Elkonite Alloy 10	Elkonite Alloy 20	Elkonite Alloy 100W
TIPALOY[5]	Tipaloy 100	Tipaloy 130	Tipaloy 200	Tipaloy T2	Tipaloy T116	Tipaloy 1	Tipaloy 10	Tipaloy 20	Tipaloy 100W
WELDALOY[6]	Weldaloy 10	Weldaloy 20	Weldaloy 30	Weldaloy 40	Weldaloy 50	Weldtung 10CT8	Weldtung 20CT	Weldtung 30CT	Weldaloy W
WEIGER WEED[7]	WW-1	WW-2	WW-3	WW-7	WW-8	WW-1W	WW-10W	WW-20W	WW-100W
WELDING SALES[8]	Tuffaloy 88	Tuffaloy 77	Tuffaloy 55	Tuffaloy 44	Tuffaloy 66	Tuffaloy 1W-3	Tuffaloy 10W3	Tuffaloy 20W-3	Tuffaloy 100W
AVAILABILITY	Bars Forgings	Bars Forgings Castings	Bars Forgings Castings	Bars Forgings Castings	Castings	Bars Inserts	Bars Inserts	Bars Inserts	Bars Inserts

[1]Ampco Metal, Inc., 1745 S. 38th St., Milwaukee 4.

[2]The Electroloy Co., 1600 Seaview, Bridgeport 8, Conn.

[3]P. R. Mallory & Co., Inc. 2029 E. Washington Ave., Indianapolis 6

[4]S-M-S Corp., 1165 Harper Ave., Detroit 11

[5]Tipaloy, Inc., 1435 E. Milwaukee Ave., Detroit 11

[6]Weldaloy Products Co., 2323 E. Nine Mile Road Hazel Park, Mich.

[7]Weiger Weed & Co., Div. of Fansteel Metallurgical Corp. 11644 Cloverdale Ave., Detroit 4

[8]Welding Sales & Engineering Co., 8750 Grinnell Ave., Detroit 13

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A Welding Engineer Reader Service

1 INERT-ARC WELDING — The Linde Air Products Co., New York City 17. 28-page booklet F-6190 explains the "Heliarc" inert-gas-shielded welding process including equipment, preparation for welding, operating instructions, welding data for 10 metals. It suggests designs for weld joints and includes detailed tables of welding current, electrode diameter and welding speed.

2 ABRASIVE DISCS — Abrasive Wheel Dept., Manhattan Rubber Div., Raybestos-Manhattan, Inc., Passaic, N. J. 6-page pocket-size folder gives a clear explanation of abrasive discs for finishing welds, including principles of operation.

3 CYLINDER CONNECTIONS — The Burdett Oxygen Co., Cleveland 14. Single-sheet bulletin on oxygen and acetylene cylinder connections and bushings, couplers, splicers and regulator adaptors. Each product is illustrated. A separate price sheet accompanies bulletin.

4 PIPING DATA—The Babcock & Wilcox Tube Co., Beaver Falls, Pa. Data card TDC 138 lists dimensions for 16 sizes of pipe from ⅛ in. to 8 in. nominal size and five different weight schedules according to wall inches and inside diameter. Piping includes seamless and welded carbon, alloy and stainless.

5 SCALING HAMMER — Jack Churchward Welding Accessories, North Haven, Conn. Single-sheet two-color bulletin on a new scaling hammer shows the multi-point head, hollow ground design of head and specially designed slag pick.

6 GRINDING WHEEL BOND—Chicago Wheel & Mfg. Co., Chicago 7. 4-page folder tells about the new vitrified bond "79E" for grinding wheels and mounted wheels.

7 BRONZE OVERLAY — Ampco Metal, Inc., Milwaukee 46. 4-page bulletin 46 shows three pictures and explains uses of "Ampco-Trode 200" in overlaying gibs on clamping jaws and slide block of a tube bender.

8 HARD-FACING MANGANESE —Rankin Mfg. Co., Los Angeles 6. 4-page bulletin outlines practical method for hard-facing manganese-steel shovel teeth and other parts. Low heat and other precautions are explained.

9 FARM WELDER — Harnischfeger Corp., Welding Div., Milwaukee 14. New bulletin gives features and specifications of the Model TR-180A a-c welder for farmers, job shops, garages, etc.

10 MOVABLE VISE—The Will-Burt Co., Orrville, O. 4-page folder illustrates 30 uses of the "Versa-Vise" including workholding for welding. Movable jaw feature is pictured.

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11 ANTI SPATTER COMPOUND —Wayne Chemical Products Co., Detroit 17. 4-page, two-color booklet tells about "Spatter-Ex" and "Flash-Ex," compounds for preventing spatter adhesion in arc and resistance welding. How to apply compound is explained as well as how it works.

12 A-C ARC WELDER—Marquette Mfg. Co., Inc., Minneapolis 14. 4-page, two color bulletin EW11501 describes and illustrates various working features of the Series 80 a-c arc welders. Specifications and dimensions are tabulated for the 200, 300 and 400 amp models. See page 44.

13 MASH-WELDER—Sciaky Bros., Inc., Chicago 38. Single-sheet, two-color bulletin tells about the Sciaky Type PMM2TL mash welding machine for joining flat sheets of pickled mild steel. Operating characteristics, construction, dimensions, controls and special features are presented. See page 46.

14 ELECTRODE CHART — The Champion Rivet Co., Cleveland 5. 9 by 24 in. chart can be wall mounted or folded to pocket size. It compares 18 makes of mild steel, stainless, hard-facing, cast iron, aluminum, tool steel electrodes as to AWS number application and position.

15 CAST IRON WELDING—Eutectic Welding Alloys Corp., New York City 13. Data sheet tells about EutecRod 14FC, a rod for high-strength welds on cast iron using the oxyacetylene process. Physical properties of the alloy are listed.

16 WELDING TRAINING — Milwaukee School of Engineering, Milwaukee 1. 20-page booklet presents the curriculum and educational facilities of the Welding Institute at MSOE. How welding fits into sales, design, management and engineering is illustrated and explained by the text. Subjects taught are outlined and their connection discussed.

17 SLIDE-SET VISE—Dodge Mfg. Corp., Mishawaka, Ind. 4-page bulletin A-601 tells about the "Slide-Set" vise for job shops, machine shops, etc.

18 ENGINE DRIVEN WELDERS —The Lincoln Electric Co., Cleveland 1. Single-sheet bulletin describes types S-7078 and S-7066 engine-driven "Shield-Arc SAE" welders. It tabulates specifications and lists features such as mountings, accessories and undercarriages.

19 VOLT AMMETER—Pyramid Instrument Corp., New York City 13. 16-page manual 110 gives instructions on use of the "Amprobe," a pocket-size, snap-on volt ammeter for checking cables and other electrical equipment.

20 SILVER BRAZING—Goldsmith Bros. Smelting and Refining Co., Chicago 36. 4-page data sheet 602 tells how to clean metals before silver brazing. It gives information on solvent cleaning, degreasing, alkaline scouring, emulsion scrubbing, tarnish removal and pickling.

21 PHASE-SEQUENCE INDICATOR—Associated Research, Inc., Chicago 18. Data sheet tells how small and handy phase-sequence indicator Model 40 operates and how it helps the repairman or maintenance crew.

22 LENS CLEANING TISSUE— The Silicone Paper Company of America, Inc., New York City 17. Single sheet bulletin tells about a silicone-coated "Magic Lens Tissue" for cleaning welder's goggles, welding plates, etc. Bulletin shows patented tissue dispenser and quotes prices on it and tissue refills. See page 45.

23 MANGANESE WELDING ROD —Taylor-Wharton Iron and Steel Co., High Bridge, N. J. 4-page bulletin 350 gives details of "Timang" welding rod for manganese steel and "Tisco" manganese steel parts for crushing and pulverizing equipment.

24 DYE-PENETRANT INSPECTION—Dy Chek Co., Div. of Northrop Aircraft, Hawthorne, Calif. 4-page, two-color bulletin 500 explains the Dy Chek non-destructive testing method for weldments, forgings and castings. Dip, brush and spray applications are shown; varied applications are indicated.

25 WELDING CLAMPS—The Cincinnati Tool Co., Cincinnati 12. 40-page catalog 49 tells about the complete Hargrave line of welding clamps, mechanics' hand tools and punches. All models are illustrated; dimensions given for each and prices listed.

26 SERIES SUBMERGED-ARC— The Linde Air Products Co., New York City 17. 26-page illustrated booklet tells about the series-arc technique of submerged-arc welding (see THE WELDING ENGINEER, January, 1951) and describes use of the method in cladding, hard-facing and surfacing operations.

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Courtesy of General Electric Co.

BIG BUCKET (25 cu yd) for excavating was welded together from plate and castings by Page Engineering Co., McCook, Ill.

Pipe and Tube Profiling

BY FRANK J. DOUGLASS

MAJOR DIFFICULTY in the use of pipe or tubing for structural members has been the preparation of the intersection to provide a perfect fit for rapid assembly and to insure an even deposit of weld metal throughout the circumference of the weld. We have overcome this difficulty at Douglass Pipe Machine Co., Pasadena, Calif., by flame-cutting with cam-actuated guided-torch machines.

Our cutting methods have been perfected to the point where pipe or tubing of any size, wall thickness or material can be cut to any curve or angular profile (see left picture). Chrome-moly or stainless tubing no longer presents a problem. All of the standard steel alloys can be cut to any desired shape without the formation of martensite or the adherence of oxide or slag to the cut edge. This eliminates the necessity of chipping, cleaning or grinding before welding.

We can handle pipe or tubing as small as ¾-in. diameter and 0.030-in. wall thickness or as large as 24-in. diameter, any wall thickness.

* * *

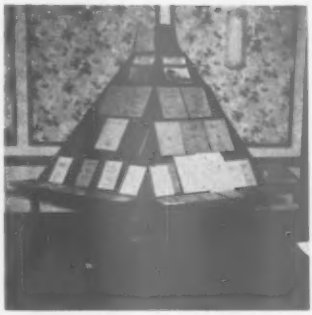
Welded Display Stand

BY LOUIS S. RUSSELL

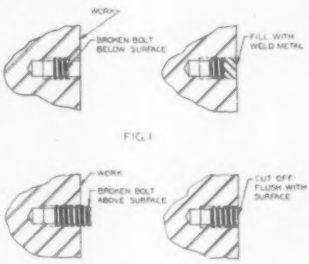
SUSQUEHANNA VALLEY section of the American Welding Society wanted a stand that would adequately display the various AWS publications. My welding class at Berwick Senior High School, Berwick, Pa., wanted useful work to do. So the boys built the all-welded stand pictured above (center).

Materials used were 20-gage sheet steel, ½ by ½ by 1/16 in. angles and 1-in. pipe. Though entirely welded in construction, the stand can be knocked down for easy portability by removing a few tapered pins.

A welded display rack of this nature would serve an equally good use in a library, newsstand or anywhere else printed matter is exhibited.



HIGH SCHOOL welding students made this display stand for AWS publications



Courtesy Nelson Stud Welding

WELD STUD to end of broken bolt after surface preparation (Figs. 1 or 2)

Welding Broken Bolts

BROKEN bolts are the maintenance man's bugaboo. When bolts break off below the surface, or so close to the surface that pliers won't secure a grip, it was formerly necessary to drill out the hole to clean out the broken portion and then retap it for a bolt of slightly larger size.

With the stud welding gun, the job is much simpler. No drilling or tapping is required—all that has to be done is to end weld a stud of the same size and threading on top of the broken bolt, and it's as good as new. You don't even have to take the bolt out of the hole.

If the broken bolt is below the surface (as in Fig. 1), fill up with weld metal and weld the stud to the deposit when you have brought it flush to the surface. If the broken bolt is above the surface (Fig. 2), cut it off flush to provide a smooth surface to which the stud can be welded.

One manufacturer reports that his average bolt replacement time has been cut from 20 to 5 minutes by following these methods.

* * *

Welds Spots on Spouts

TO JOIN spouts to stainless-steel coffee pots, Taylor-Winfield Corp., Warren, O., designed a special series spot welder that puts two pouring spouts on two pots in one operation. The 6-in.-long watertight seams around the spouts are each made up of 66 separate spots. Both seams are welded in only 20 seconds.

Unloading and reloading are so rapid that one operator could service three such welders, on which basis 770 spouts an hour could be welded. Spot spacing, work indexing and electrode operation are automatically controlled. Electrodes are always normal (perpendicular) to the surface being welded.

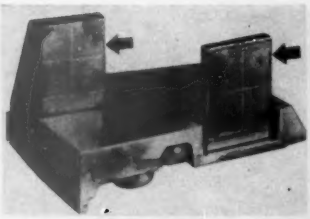
External appearance of the seams is so good that a minimum of polishing is required on the highly reflective surface.

* * *

Pegs Take a Pounding

THE LITTLE pegs in a huge Riley coal pulverizer take a terrific beating in their job of reducing coal to talcum-powder fineness. In one particularly troublesome installation, the cast pegs used were considered to have a satisfactory service life if they could last through 3,500 tons of coal.

Some bright soul thought of changing



Courtesy Handy & Harman

COAL PULVERIZER pegs were made by facing the forged steel with carbide

the cast pegs to forged steel pegs faced with carbide. Excellent, but how to attach the carbide facings to the forged pegs? The idea was about to break down on the production details when a way out was found.

The carbide facings are now silver brazed to the pegs with a semiautomatic gas burner set-up having a capacity of 100 pegs per hour. A silver alloy flowing at 1,270 F is used. Some of the brazed pegs have been in operation for months and show no appreciable wear after pulverizing upwards of 30,000 tons of coal—almost ten times the 3,500 tons once considered a good record.

* * *

ASSEMBLING parts for space heaters: simple stampings welded together have replaced deep-drawn shapes or castings

Complex Shapes from Stamping

AMERICAN GAS MACHINE CO., Albert Lea, Minn., is using welding to form complex shapes out of simple stampings and thereby reduce the cost of manufacture. The company makes stoves, water heaters, space heaters and other products.

In the manufacture of space heaters, various castings and deep-drawn shapes are replaced with simple cylindrical and flat parts, welded together. Advantages are reduced weight, increased strength, quality products at a reduced production cost.

The stampings are joined together by seam welding where a solid full length is needed for gas tightness or by spot welding if the joint does not require protection against leakage. Parts are assembled and fed through the welder as shown in the picture. Welding requires only a few seconds, at the most.

You can change these Smith 1 Tips in 6 Seconds

- No wrench necessary
- Fingers do the job
- Fast line-up of tip
- Fast change from welding to cutting

How do you like that for fast, efficient operation? No searching for wrenches—no wasted time. Just use fingers only. In actual demonstrations, operators have been able to remove and replace 4 tips in the time another operator could remove and replace 1 tip in an old fashioned model. And the seal stays tight even if tip is battered or nicked!

This is the kind of progress modern industry needs and wants. But it's not the only advantage you get with this new Smith equipment. Note that the Cutting Assembly can be attached just as quickly as a tip and the new "FLO-TROL" feature eliminates reverse flow of gas—prevents burned out seats. Keeps torch on the job . . . does away with costly delays. Another ingenious feature permits rotating the tip **while flame is burning!** (Heavy Duty Torch Body and Cutting Assembly, illustrated above, carries Lifelong Guarantee).

THAT'S ALL! . . . JUST *6 SECONDS;* IT'S NEW AND REVOLUTIONARY

MAIL COUPON TODAY FOR DETAILS

SMITH WELDING EQUIPMENT CORPORATION

Manufacturers of fine Welding Equipment for over 40 Years

Smith Welding Equipment Corporation
2635 S.E. 4th, Minneapolis, Minn.

Please send me more information on the time-saving and money-saving features of your new torch.

Name_____

Address_____

City_____ State_____ 1-2

Official U. S. Navy Photo

ALL WELDED ALUMINUM patrol torpedo boat launched at Annapolis, Md., shipyard. First ever built, it is 95 ft long and 25 ft. wide. For more details, see page 57, January issue

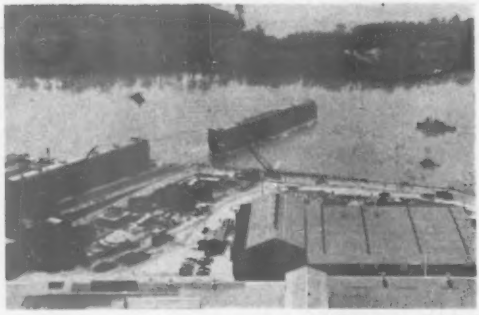


Photo courtesy U.S. Steel

FLOATING 300-FT welded highway tunnel section begins 125 mile voyage to Houston, Tex., tunnel site. One tug pulls, another steers big tube. Welded bulkheads seal tunnel ends

NEWS

World Welding Congress at London Next July

THE International Welding Congress will be held at London and Oxford, England, from July 14 to 21. British organizations working on plans for the meeting include the Institute of Welding, the British Welding Research Association, the British Acetylene Association and the British Electrical and Allied Manufacturers' Association. The man in charge of arrangements for the meeting is G. Parsloe, secretary general of the International Institute of Welding, 2 Buckingham Palace Gardens, Buckingham Palace Road, London, S. W. 1.

* * *

Ask New Standard for Stainless Piping

MANUFACTURERS of stainless steel pipe and fittings recently met with delegates from the chemical industry to request inclusion of Schedule 5S stainless pipe as an American Standard. This type of piping and fittings has been manufactured for the last two years.

Among companies represented at the meeting were: Carbide and Carbon Chemicals Division, Union Carbide and Carbon Corp.; American Cyanamid Co., Eastman Kodak Co., Tennessee-Eastman Corp., M. W. Kellogg Co., Ladish Co., Crane Co., Taylor Forge and Pipe Works, Tube Turns, Inc., Welding Fittings Corp.

* * *

J-48 Jet Engine Contract Goes to Hotpoint, Inc.

MAJOR components and sub-assemblies of the J-48 jet engine will be made at Hotpoint, Inc., Cicero, Ill., plant. The contract for the engines was made with Pratt & Whitney division of United Aircraft corporation.

Hotpoint's brand-new 1,000,000 sq. ft. plant in Cicero was designed for the manufacture of refrigerators. With the cutback in materials for civilian goods, the factory will produce war goods.

It will be 8 or 10 months before the plant gets into production on the engine parts, say company officials, but it will be one of the first consumer plants to complete the change-over.

The J-48 engine, known as the "Turbo-Wasp," is one of the most powerful engines in this country. It develops 6,250 lb thrust in normal operation, with greater thrust available through water injection and afterburners. It powers the Navy's F9F Grumman Panther jet fighters now flying off carriers in the Korean area and the Lockheed F-94C all-weather interceptors guarding our big cities.

Chrysler corporation will build a new plant outside Detroit to make the J-48's, according to latest word. Another Chicago activity, the huge wartime-built Dodge plant, will produce the Pratt & Whitney R-4360 "Wasp-Major" piston engine under the supervision of Ford Motor Co.

* * *

Texas Tunnel Sections Take 125-Mile Water Trip

FIRST 300-ft section of a new 2,550-ft vehicular tunnel for the Texas Highway department recently slid down launching ways at Orange, Texas. The 35-ft diam welded section then made a 125-mile journey by water to the Houston Ship Channel, where it was to be installed. The sections are welded from ½-in. plate, stiffened by annular T-sections. There are six sections 300 ft long and three 250 ft long to be floated down the Sabine river.

To make each section seaworthy for towing, a watertight bulkhead of 7/16 in. plate, reinforced with 18-in. and 24-in. WF stiffeners was welded to each end.

End launching of the sections imposed critical compressive stresses on the upper shell so I-beam stiffeners were tack welded along the top outer surface crossing the point of maximum bending moment. Sections were built and launched at Orange by Consolidated Western Steel Corp., a U. S. Steel subsidiary.

When afloat in the quiet waters of the Sabine river, tie rods were removed and the tube checked for distribution of its 75 tons of ballast (steel reinforcing material). The 125-mile journey was accomplished by two tugs, one towing and the other keeping the big tube on course by draglines.

A deep ditch is being cut across the floor of the Houston Ship Channel to receive the tunnel sections, which will be lined with reinforcing concrete and the roadway laid before they are sunk 50 ft into the channel bed. When this is done, the joints will be sealed by steel bands and concrete, after which the bulkheads will be removed.

* * *

Tool Engineers Talk Inert-Arc Welding

ONE of the most important production technique papers to be presented at the American Society of Tool Engineers annual meeting in New York City, March 15 to 17, will cover inert-gas shielded arc welding.

Other papers will cover a variety of subjects involving welding equipment. One will be a discussion of the economics of machine replacement. Another will be part of a symposium on the non-destructive testing of metals.

HIGH-VOLTAGE RADIOGRAPHY

cuts exposure time from hours to minutes...

Photo courtesy Babcock & Wilcox

Provides proven dependability year-in... year-out plus low-cost operation

Vessels which would take up to eight hours or longer to radiograph with lower-voltage x-ray units take as little as six minutes with 2,000,000 volt industrial x-ray units like the one shown above. And the detail improvement over low-voltage radiography is dramatically apparent.

Scores of companies rely on high-voltage radiography, not only as an inspection tool — but as a development tool for establishing new welding technics. The high-voltage x-ray unit illustrated is noted for its low-cost operation and absolute dependability. In fact, its economy is summed up by many users like this: "From a cost standpoint, high-voltage x-ray appears to be the more economical method of inspecting fusion welding in pressure vessels."

Radiography may be the answer to your own welding inspection and development problems. Write today for full information. General Electric X-Ray Corporation, Dept. AE-2, Milwaukee 14, Wis.

GENERAL ELECTRIC
X-RAY CORPORATION

Compare THE miller MODEL 88

with any other Welder of its type regardless of cost...

★ Rugged heavy duty welder throughout.
★ 220 volts, 50-60 cycle units are standard (dual voltages at additional cost).
★ Continuous current adjustment with handle on top.
★ Underwriters' Laboratory approval.
★ Welding leads detachable.
★ Power switch provided.
★ Double glass covered magnetic wire used in transformer coils.

Four casters are normally provided on the Model 88 . . . a 3 wheel truck with towing handle available at additional cost.

MILLER Model 88 is a rugged heavy duty welder built expressly for general welding, maintenance and production welding . . . built for long, trouble-free service in industrial plants, job shops, garages or any place where an industrial type welder is needed. It is shipped complete with welding helmet, 18 feet of flexible ground cable with ground clamp and 18 feet of electrode cable with insulated electrode holder attached. The 220 volt welders are provided with 8 feet of primary cable, plug and wall receptacle. (Dual voltage welders are provided with 8 feet of primary cable only.)

Two open circuit voltages are provided. This combines easy arc starting with a lower KVA demand load and primary amperage draw.

Write for complete specifications.

Call on your MILLER distributor for complete information and demonstration of the MILLER 88 industrial AC arc welder.

Since 1929 ARC-SPOT miller WELDERS

other miller *products*

7 models for "HELIARC" welding

WELDERS AND TIMERS FOR "HELIARC" SPOT WELDING.
SELENIUM RECTIFIER D.C. WELDERS FOR "HELIARC" WELDING AND METALLIC ARC WELDING.
A.C. WELDERS FOR METALLIC ARC WELDING.
SPOT WELDERS.

miller ELECTRIC MANUFACTURING CO. APPLETON WISCONSIN

Southeastern Distributors Meet at Chattanooga

FORTY-ONE members and affiliates of the National Welding Supply Association journeyed to Chattanooga on Dec. 5 for a one-day southeastern zone meeting. W. A. Rice, Virginia Welding Supply Co., Charleston, W. Va., zone vice-president, was in charge.

National president Glenn G. Garman gave the first talk of the day, an excellent review of the advantages of membership in a trade association. M. E. White, president of Welding Gas Products Co., Chattanooga, led a discussion on methods to control inventory.

Orders affecting the welding industry through the National Production Authority were discussed during the remainder of the morning. The speakers explained defense order designations and how they work.

Ernest Clevenger, vice-president of Corley Mfg. Co., Chattanooga, talked after lunch on good salesmanship and how to develop it. Thomas Taul, Jr., Mobile Welding Supply Co., Mobile, Ala., discussed the methods his firm uses to improve customer relations. W. A. Rice talked about the most useful features he found in manufacturers' catalogs, price sheets, sales manuals, advertising and direct mail literature.

Leslie P. Beaver, Jr., Beaver Welding Supply Co., Memphis, Tenn., outlined reasons for his firm's participation in the NWSA annual overhead expense reports. James N. Alcock, Saginaw Welding Supply Co., Saginaw, Mich., was scheduled to talk at this meeting but was unable to be present. Alcock's paper on the importance of aggressive merchandising was read by President Garman.

Welding firms signing membership applications at the Chattanooga meeting were: Alabama Oxygen Co., Birmingham, Ala.; Bashlor-Sowers Welding Service, Inc., Bluefield, W. Va.; Chattanooga Welders' Supply Co., Chattanooga, Tenn.; Dixie Gases, Inc., Atlanta, Ga.; National Welders Supply Co., Inc., Charlotte, N. C.

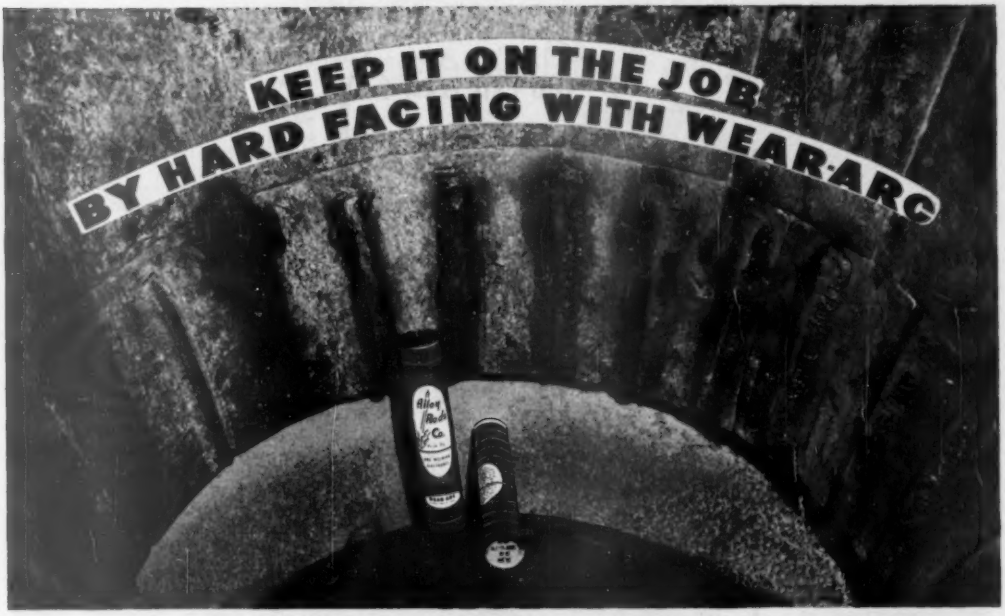
* * *

Big All-Welded Tanker Launched in Britain

THE largest oil tanker ever built in Britain was recently launched at the Barrow shipyards of Vickers-Armstrong, Ltd. The all-welded *British Adventure* displaces 28,000 tons and was built largely from prefabricated sections, some as large as 40 tons. When using such welded sections, the ship may be built up towards the bow. Construction is so fast by this method that only a current shortage of British shipwrights is preventing much faster building.

The new tanker was built for the British Tanker Co., Ltd., subsidiary of Anglo-Iranian Oil Co., Ltd. She will carry oil from the Persian Gulf to new refineries on the Medway and at Swansea.

—McGraw-Hill World News



This Bell Crusher Concave was completely salvaged by welding, in vertical position, 1" round manganese steel bars to the worn manganese steel casting. The bars help hold and crush hard stone. Bars were welded with 5/32" WEAR-ARC WH electrodes and hardfaced with 3/16" WEAR-ARC 12 electrodes to provide an extremely hard wearing surface against impact and abrasion.

Bucket tooth life can be increased many times by welding manganese steel wedge bars to the worn tooth point with 3/16" WEAR-ARC WH electrodes, and by hard facing the entire surface of the tooth with 3/16" WEAR-ARC 12, electrodes.

WEAR-ARC Will Last Longer Against Abrasion and Impact

To reclaim worn equipment and protect parts against excessive wear, you will find one, or a combination of two, of the seven basic WEAR-ARC hard facing electrodes does the best job . . . increases life as much as four times or more.

WEAR-ARC WH is ideal for build up and high strength welds on manganese steel; WEAR-ARC 12 for providing that hard wearing surface. Ask for bulletin No. 10550, illustrating and describing properties and welding procedures for the complete line of Wear-Arc hard facing alloys.

Ninty-five pound impactor hammers of manganese steel are built up with WEAR-ARC WH and hard faced with WEAR-ARC 12. Life of new hammers can be increased many times by hard facing with WEAR-ARC 12 electrodes.

"I Like the rod that comes in the RED can"

SEE YOUR NEAREST
ALLOY RODS DISTRIBUTOR

ALLOY RODS CO. York, Penna.

NO MATTER HOW YOU HEAT...

The method of heating for low temperature brazing is a decided factor in the selection of the right silver solder and flux. Specify GB and you're right, because you'll get a combination that was made to work right!

OXY-ACETYLENE
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AIR-GAS
SALT BATH
BUNSEN BURNER
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OXY-PROPANE
OXY-CITY GAS
CARBON TONGS
RESISTANCE
FURNACE BRAZING
CHARCOAL
BLOW PIPE

GB's line of six standard silver solders offers a range which meets standard production methods. When special solders are required, GB's Technical Service Division offers assistance which is based on experience in alloying and refining precious metals that goes back more than 80 years.

GB Standard Silver Solders

GB No. 50	Silver Solder, melting range	1160-1175°F
GB No. 50N	Silver Solder, melting range	1240-1260°F
GB No. 45	Silver Solder, melting range	1125-1145°F
GB No. 41	Silver Solder, melting range	1125-1160°F
GB No. 35	Silver Solder, melting range	1130-1270°F
GB No. 31	Silver Solder, melting range	1130-1300°F

GB FLUXES

The physical properties and appearance of a brazed joint are controlled to a large degree by the flux which is used. For this reason it will pay you to team-up GB Flux with GB Silver Solder — they were developed to produce maximum results when used together.

GB DATA BOOK

Here's real factual data on all of the important phases of low temperature brazing. You can get a free copy from your GB Distributor — Write us and a copy will be forwarded to you.

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1304 W. 59th Street, Chicago 36, Illinois
Suppliers of Precious Metals to Industry Since 1867

Cast-Weld Construction Pushed by Steel Founders

How to combine welding and casting in the new "cast-weld" construction was told at the recent technical and operating conference of the Steel Founders Society of America, held in Cleveland.

Redesign and conversion to cast-weld construction was lauded by A. H. Suckow, metallurgist, The Symington-Gould Corp., Depew, N. Y. As a successful example of developmental work of this type, he told about Symington-Gould's conversions of freight car center fillers and strikers. Because of the costs in coring original casting design, some car builders had developed an all-welded design calling for 17 parts and 672 lineal inches of welding. Symington-Gould produced a new design consisting of two cast steel side pieces and a separate center piece. This enabled a reduction of core weight from 308 lb to a mere 3 lb per casting, a reduction of 638 inches in lineal weld and 30% reduction in weight.

A. L. Wentzel, works manager, Birdsboro Steel Foundry and Machine Company, cited as an example of cast-weld redesign a casting for a 19,000-lb high-pressure gas pump. On the front of the massive cylindrical casting forming the body of the part, three blades were welded into place. The base was also made of a casting and plate welded to the main casting. The rear of the piece incorporated the drive housing of light plate construction with a cast bearing welded to the thin plate.

* * *

"Build-A-Tool" Plans Given by Lincoln

Farmers can get free plans of labor-saving devices and farm equipment that can be built with an arc welder and other shop tools from the Lincoln Electric Co., Cleveland 1. The plans show major dimensions and give all the materials needed. The seven plans now ready show how to build: a tractor-mounted buzz saw, a post hole digger, a grain blower, a farm trailer, a two-wheeled tool carrier, a swing-type table saw and a wall-type door holder. These plans have been checked by several agricultural engineering departments at leading universities.

* * *

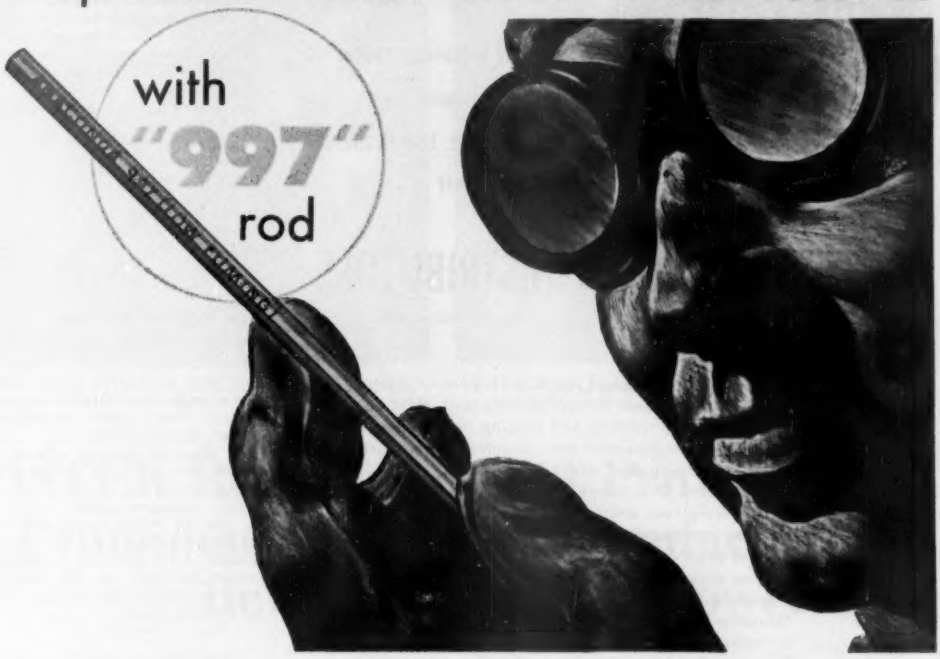
National Metal Show Scheduled for Oct. 15-19

The 33rd National Metal Congress and Exposition has been set for Oct. 15-19, 1951, at Detroit. Exhibits will be at the Michigan State Fair Grounds. Technical sessions will be in principle downtown hotels in Detroit.

As usual the sponsors will be the American Society for Metals, American Welding Society, American Institute of Mining and Metallurgical Engineers, Metals Branch and Society for Non-Destructive Testing.

Information headquarters address is National Metal Congress, 7301 Euclid Ave., Cleveland 3, O.

7" lap seam braze-welded in 25 seconds



THAT'S FAST TIME for braze-welding an automobile rear-quarter panel. And it's maintained.

Another large manufacturer in the same line says braze-welding with ANACONDA "997" Welding Rod eliminated five assembly operations in his production schedule.

ANACONDA "997" Rod is low fuming, has a low melting point (under 1600° F.), works fast.

For more information on this and other ANACONDA Welding Rods for better, money-saving, time-saving welding, write for Publication B-13. ANACONDA Welding Rods are available from distributors throughout the United States. The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass, Ltd., New Toronto, Ont.

you can depend on

ANACONDA®

BRONZE WELDING RODS

WELDING SPECIALISTS

helping America rearm with Aluminum should have the technical help of their

LOCAL ALCOA DISTRIBUTORS

How do you make good joints in aluminum? Simply add a few techniques to your present skill. Have an expert do some welding and brazing in your own shop. Talk over your jobs with him. Hundreds have learned this way through their Alcoa Distributors.

Your Alcoa Distributor offers booklets and movies to help train your employees. A staff of aluminum welding experts who'll gladly work with your shop men. A stock of the world's best aluminum welding and brazing supplies.

Look for your local Alcoa Distributor listed under "aluminum" in your classified phone book. Or write ALUMINUM COMPANY OF AMERICA, 1943B Gulf Building, Pittsburgh 19, Pennsylvania.

Thick sections of aluminum can be welded quickly and economically. Your local Alcoa Distributor can show you how it's done.

ALCOA FIRST IN ALUMINUM

Welding and Flame-Cutting Make Allies' Biggest Tank

WELDING and flame-cutting are major production methods for turning out the 50-ton Centurion tanks, heaviest in use by the Allied nations. Made at the Barnbow Royal Ordnance Factory in England, the tank mounts a 20-pounder gun and is powered by a 635-hp gasoline engine.

The tank hull is welded from heavy armor plate. Turret of the tank is a single casting weighing 7½ tons. Large positioners are used for down-hand welding wherever possible. One of the latter has a platform 38 ft long powered by two 30 hp motors.

—*McGraw-Hill World News*

* * *

Use Welder-Generator To Power Police Radio

GASOLINE engine driven welders can also serve as standby power units for police radio installations, reports the *Memco News*, plant publication of Miller Electric Mfg. Co., Appleton, Wis. Since the majority of most police radios, even complex set-ups, can be operated with less than 2 kw, a combination generator-welder could easily fill the bill. One well-known welder, for instance, has a d-c generator that provides 1 kw and an a-c welding generator that puts out 200 amp of 90 cycle welding current or 3 kw of regular 60 cycle power.

* * *

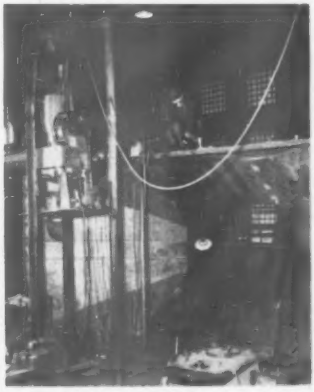


Photo Courtesy The Linde Air Products Co.

Welder on Elevator Rebuilds 400 Ore Cars

INCREASED flexibility of their submerged-arc semi-automatic welder in repairing ore cars was managed by Great Northern railway shops by placing the rod and flux feed machine on an air-operated elevator (shown above). Range of the welder was increased more than 80% in this way.

In the raised position, plug welds were made through rivet holes on reused side stakes. Lowered, the flexible welder was used to make butt welds between end and side slope sheets.

Valuable space is conserved and machines are kept clean by locating them on balcony. With *FOSTER Remote Control* operators can start and stop, change polarity and regulate current at the holder. No trips to welders are necessary.

George Anderson, Webb's Chief Electrician, is enthusiastic as he shows James Van Winkle, Ass't Sup't, just how the operators obtain complete control of their machines. Typical Webb work is shown at left.

FOSTER Remote Control Provides Prominent Conveyor Manufacturer Better Welding at Lower Cost

BY CLAYTON B. HERRICK

Outstanding producer of material handling equipment obtains highly satisfying results and slashes costs of operation by installing *Remote Control Device*.

THE name of Jervis B. Webb and material handling conveyors is synonymous. This leading company manufactures conveyors of all types for industrial use from coast to coast. With headquarters in Detroit and additional manufacturing facilities in California and also Canada, their reputation is well known.

Among the types of conveyors which are produced by Webb are overhead, floor, slat and belt. The welded fabrication is confined to the shop and field crews handle the erection operations. Material used ranges from 16 gauge to 1¼" plate and includes stainless steel as well as carbon steel.

FOSTER'S Remote Control Device proved to be "just what the doctor ordered" for this company. On field jobs which involve all position welding and where the operators usually work far from the welding machines (often two to five floors above) it is easy to understand how invaluable it was to have complete control *right at the electrode holder*.

No time is lost in this way in changing polarity or in resetting the current. No compromise settings, which tend to decrease efficiency and affect quality adversely, need ever be used.

In the Detroit plant Webb has placed their welding machines on a balcony in order to conserve space and keep them clean as possible. Operators were required to cross the shop and climb a ladder each time welding current had to be reset. Time and energy were wasted. On fit-up work, where operating factor was low, machines were running continually. *Now*, with complete control right at the holder all this is eliminated. Time, current and money are all saved.

The answer to better welding at lower cost lies in *FOSTER Remote Control* where the operator can make all adjustments without moving out of position.

Those interested in knowing more about FOSTER Remote Control for DC Arc Welders should write for catalog containing complete details offered by FOSTER TRANSFORMER COMPANY, 3820 Colerain Avenue, Cincinnati 23, Ohio.

How FOSTER Remote Control Operates

THE equipment consists of a holder, welding cable with three control wires spiralled under the rubber sheath and a control box mounted on the machine. The operator can start and stop the machine, change polarity and control heat over three rod sizes without returning to the machine.

The welder is completely controlled by two knobs mounted at the rear of the holder grip. The front knob adjusts the heat with smooth stepless control. The rear knob controls polarity and starts and stops the machine. The holder is a standard popular make and is replaceable.

The *Control Box* is made from stainless steel. Component parts, such as relays and transformers are built to give long trouble-free service. The *cable* is made by a well known cable manufacturer. There are three No. 20 rubber covered control wires rope spiralled with the main conductor cable. The overall sheath is standard heavy rubber construction. Prices are competitive with standard cable.

Foster Transformer Co.
3820 Colerain Ave.
Cincinnati 23, Ohio

Please send further information on FOSTER REMOTE CONTROL.

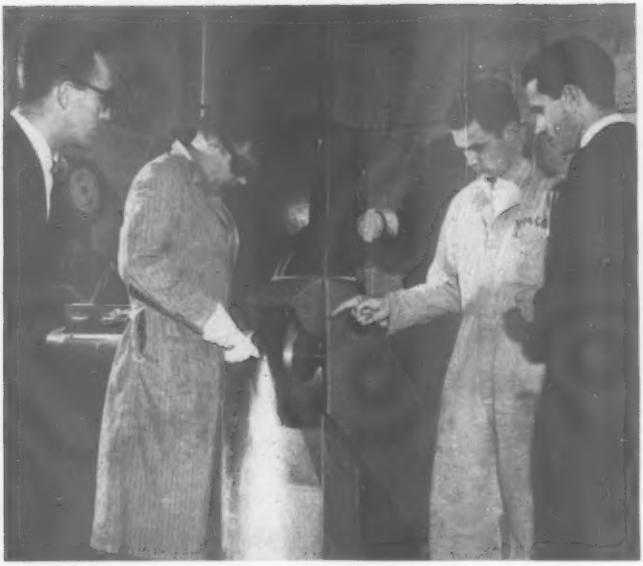
Name .....

Title .....

Company Name .....

Address .....

City ..... **State** .....



ABRASIVE EXPERT helps customers at one of the new 3M Demonstration Rooms.

Grinding problems? Bring them to a 3M Demonstration Room!

Grinding costs too high, production too slow? You can get fast, *expert* help at the nearest 3M Demonstration Room, staffed with 3M Methods Engineers.

Skilled operators will grind samples from your production line, work out new methods and recommend the type of coated abrasive that's best, most economical for the particular job.

Come in anytime with any kind of problem—from heavy grinding to fine finishing. Chances are we can assist you. 3M Demonstration Rooms: Boston, Chicago, Cincinnati, Cleveland, Detroit, Grand Rapids, Los Angeles, New York, Philadelphia, St. Louis, St. Paul, San Francisco, and Seattle. Send the coupon below for further information.

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St. Paul 6, Minn.

☐ Please have a 3M Methods Engineer call.

☐ Please send copy of new "Step Up Production" booklet explaining the 3M Method of Grinding and Finishing.

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Made in U.S.A. by MINNESOTA MINING & MFG. CO., St. Paul 6, Minn., also makers of "Scotch" Brand Pressure-sensitive Tapes, "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-Slip Surfacing, "3M" Adhesives. General Export: Durex Abrasives Corp., New Rochelle, N. Y. In Canada: Canadian Durex Abrasives Ltd., Brantford, Ontario.

Southwest Distributors Meet at Fort Worth

THE largest number of members and affiliates ever to attend a southwestern zone meeting of the National Welding Supply Association got together at the Texas Hotel in Fort Worth, Tex., on Dec. 7. Presiding over the 44-man meeting was Charles O. Stilwell, zone vice-president. National president Glenn G. Garman, of Grand Rapids, Mich., was also present.

A. L. Hill, Dallas Welding Supply Co., Dallas, Tex., led the first discussion of the day on the topic, "What a distributor thinks essential in manufacturers' catalogs, salesmen's price sheets, sales manuals, advertising and direct mail literature."

Remainder of the morning was devoted to a discussion of the effect of the priority and allocation program on the welding industry. The several orders issued by the National Production Authority affecting welding were explained.

Following lunch, Charles O. Stilwell talked on the methods NWSA members use to control inventory efficiently. Howard R. Proctor then spoke on methods used to improve customer relations.

N. E. Elam, Industrial Welding Supply Co., Houston, led a review of the detrimental effect of manufacturers' competition. A roundtable discussion on demurrage practices and problems followed Mr. Elam's talk.

Six distributors signed applications for membership during the meeting. They are: Capital Welding Supply Co., Little Rock, Ark.; Industrial Welding Supply Co., Fort Worth, Tex.; Louisiana Welding Supply Co., Baton Rouge, La.; Welders Supply Co., New Iberia, La.; Welders Supply, Inc., Dallas, Tex.; Welding Equipment Co., Oklahoma City, Okla.

* * *

Cornell to Build Metals Processing Lab

A $1,700,000 laboratory for the study of materials and methods of processing them will be built at Cornell University, Ithaca, N. Y.

Building has started at this time and is scheduled for completion sometime in 1952. Consisting of two adjoining units, a Materials Laboratory and a Materials Processing Laboratory, the building will be made of red brick, limestone and native stone. It will contain 1,300,000 cu ft of space in an overall length of 245 ft and a depth of 135 ft.

An unusual bay for research in structure will be a feature of the Materials Laboratory. The main floor of the bay will be large enough to permit load experiments on a 90-ft, two-lane highway bridge.

The Materials Processing Laboratory will contain facilities for research in machine tool production methods, the machining and welding of metals and the development of plant layouts.

Churchward Welding Moves to New Plant

CHURCHWARD Welding Accessories, subsidiary of the Alfred B. King Company, was recently involved in a move to the new King plant in North Haven, Conn. With King's other subsidiary, KIF Industrial Fabricators, Churchward will share a modern 2,200 sq ft office building and a 3,000 ft warehouse. Production space in the new plant totals 10,000 sq ft.

Coincident with the move and expansion of facilities, the King organization has augmented its designing staff and moved it into the engineering department.

Formerly of 200 Winchester Ave., New Haven, Conn., the King company is a distributor for cranes, electric trucks and conveyors. Its recently organized subsidiaries produce patented welding accessories and materials handling equipment.

* * *

Thermit Weld Repairs Army Transport Ship

A BROKEN stern frame last year on the army transport, *General C. C. Ballou*, was repaired in five days. Two large welds had to be made, the largest at a section 54-in. long by 20-in. wide.

The repair was made at the Brooklyn Yard of the Todd Shipyards Corporation. Repair started late on a Wednesday night. A new forged steel section had first been prepared, set in place and aligned in the skeg of the ship's stern frame adjoining the propeller post. Both welds required setting up of mold boxes, ramming, preheating and finally pouring of Thermit mixture.

Welds were complete on Monday including chipping and inspecting. Alignment of the frame after welding was so good that it wasn't necessary to rebore the rudder gudgeons.

The larger weld required 1,600 lb of Thermit, the smaller some 700 lb.

* * *

New Distributors

AIR REDUCTION SALES CO., New York City: The S. J. Smith Co., Davenport, Ia., will serve Scott County, Ia., and Rock Island County, Ill., with a complete line of gas and electric welding equipment.

* * *

MACDERMID, INC., Waterbury, Conn.: Donald Sales and Mfg. Co., Milwaukee 13 will handle Wisconsin as exclusive distributors for metal cleaners, bright copper and metal finishing preparations.

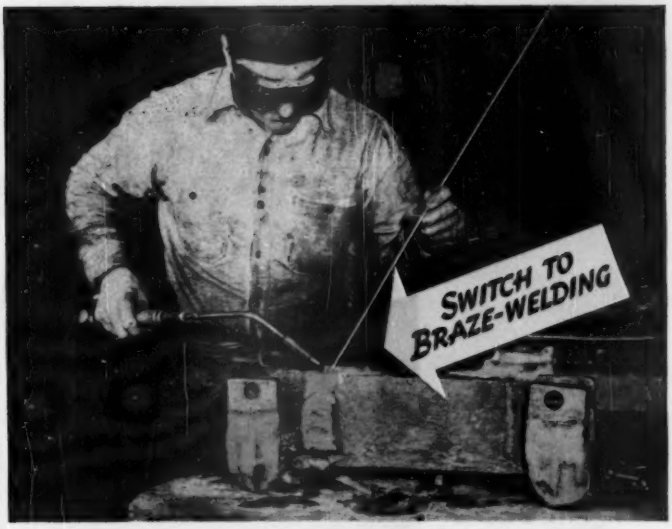
* * *

NELSON STUD WELDING DIV., Lorain, O.: Western Oxygen Company will distribute stud welding guns and studs for Oregon and Washington.

* * *

Niagara Falls Firm Moves

SUPERIOR Welding & Boiler Works, Niagara Falls, N. Y., recently moved to new office and plant facilities at 139 18th St. in that city.



REDUCING "DOWN TIME" WITH BRIDGEPORT No. 192 LOW FUMING BRONZE ROD

Making quick, reliable repairs on broken cast iron and steel equipment means less interruption in vital production. Every welder should be thoroughly familiar with the advantages of braze-welding. Instead of costly delay and expensive replacement, this crane gear housing for a reduction unit was back in normal service quickly, thanks to Bridgeport's No. 192 Low Fuming Bronze Rod.

No over-all preheating, slow cooling, or elaborate repair set-ups were needed. The break was cleaned and properly prepared, then heated to redness. Bridgeport's No. 192 welding rod has excellent "tinning" and "filling" action and produces a deposit that is strong and ductile.

There's a wealth of information on braze-welding and bronze welding alloys in Bridgeport's booklet "Bronze Welding Alloys". Write for your free copy of this 24-page booklet today.

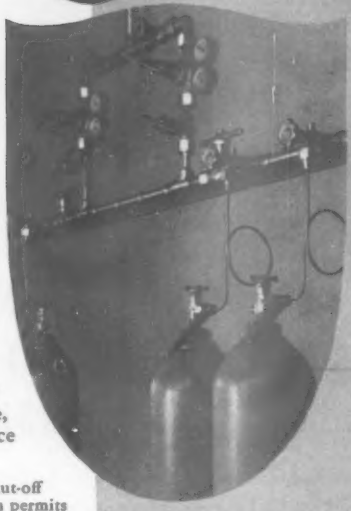
"Bridgeport" BRASS CO.

BRIDGEPORT BRASS COMPANY
Bridgeport 2, Conn. Established 1865
Mills at Bridgeport, Conn., and Indianapolis, Ind.
In Canada: Noranda Copper and Brass Limited, Montreal

Bronze Welding Rod A PRODUCT OF **BRIDGEPORT BRASS**

REGO

MANIFOLDS



Rugged construction and precision control equipment give RegO manifolds long life, safe, dependable performance and low maintenance.

Continuous Operation . . . Shut-off valve at each cylinder station permits removal of any cylinder without shutting down entire side of manifold. Master valves control each bank of cylinders.

Unit Construction . . . Header consists of steel I-beam, extra heavy brass pipe and fittings, cylinder stations and master shut-off valves . . . *with all permanent connections silver brazed.*

Precision Regulation . . . Uniform delivery pressure is assured by dual large capacity two-stage RegOlators.

Listed by Underwriters' Laboratories, Inc. and Factory Mutual.

Write for 24-page catalog giving complete specifications.

Typical Single Regulator Wall-Type Oxygen Manifold

Typical Dual Regulator Floor-Type Acetylene Manifold

for
OXYGEN
ACETYLENE
HYDROGEN
NITROGEN
and other high pressure gases

*Reg. U. S. Pat. Office

PIONEER AND LEADER IN THE DESIGN AND MANUFACTURE OF PRECISION EQUIPMENT FOR USING AND CONTROLLING HIGH PRESSURE GASES

The BASTIAN-BLESSING Company
4201 West Peterson Ave. Chicago 30, Illinois

New Color Film Made on "Aircomatic" Process

AIR REDUCTION Sales Co. has completed a 21-minute, color, sound movie that explains the principles of the "Aircomatic" or inert-gas-shielded-metal arc welding process and gives demonstrations of the welding of aluminum, stainless steel, bronze and Monel. The film is 16 mm and comes in two reels. To make arrangements for showings, write to the nearest Airco office or to Air Reduction, 60 East 42nd St., New York City 17.

* * *

Inspection Periodical Started by Dy-Chek

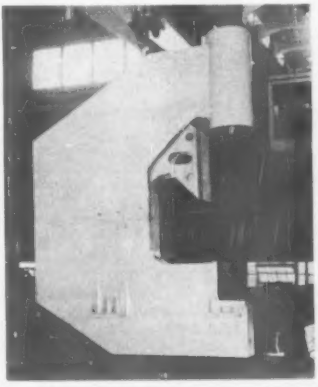
To provide an interchange of technical information and shop-talk about its new inspection process (see THE WELDING ENGINEER, Nov., 1950, page 38), the Dy-Chek Co. has inaugurated a monthly letter, "Inspection Clinic," that tells uses and gives suggestions for best results with the new dye-penetrant equipment. Dy-Chek is a division of Northrop Aircraft, Inc., Hawthorne, Calif.

* * *

Distributors

TUBE TURNS, INC., Louisville, Ky.: Bethlehem Supply Company and the Bethlehem Supply Company of California will handle Tube-Turn welding fittings and flanges. The former concern is a subsidiary of Bethlehem Steel Company and has main offices in Tulsa, Okla. Its oil country stores and service organization cover Arkansas, Colorado, Illinois, Kansas, Louisiana, Mississippi, New Mexico, Oklahoma, Texas and Wyoming. The Bethlehem Supply Company of California is a subsidiary of the Bethlehem Pacific Coast Steel Corporation. Its main offices are in Los Angeles.

* * *



29-TON WELDMENTS were needed for housing sections of a giant hydraulic press built by Ingalls Iron Works Co., Birmingham, Ala. Press will be used at Ingalls' Southside plant

PAGE *Welding* ELECTRODES

Page-Allegheny *Stainless Steel*

AC or DC

ARC
—stable even at very low amperage

SLAG
—clean, easily removed

COATING
—resists cracking down to very short stubs

SELECTION
—complete line for welding every type of stainless

Ask your Page Distributor about these improved Stainless Steel Electrodes

ACCO

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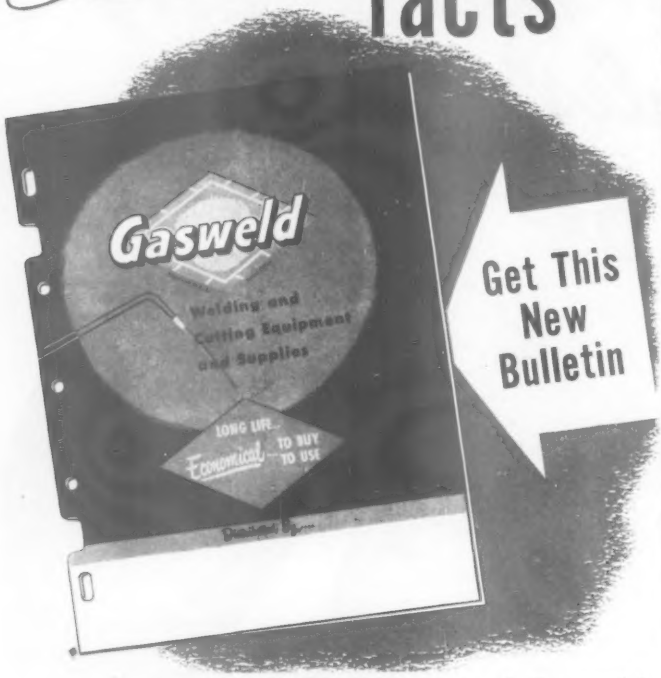
Streamlined facts



on Liquid's Economical Gasweld Welding-Cutting Equipment Line

Ask for your copy *now!* Check! Compare! Know the advanced features of *versatile* Gasweld Equipment welding and cutting torches, complete outfits and supplies. There's a Gasweld unit for every light or heavy duty operation. Whatever the job—weld or cut with greater ease and economy with Gasweld. It's the preferred, long-life equipment for production or maintenance work in large shops or small. *Write today!*

THE LIQUID CARBONIC CORPORATION
Industrial Gas Division
3100 South Kedzie Avenue • Chicago 23, Illinois

ORDER THROUGH YOUR LOCAL JOBBER OR WRITE US DIRECT

Tweco Moves Factory To New Building

TWECO Products Co., manufacturers of electrode holders, cable connections and other welding equipment, has moved into a new building at Boston and Mosley Streets in Wichita. Former address was English at Ida. Their P. O. Box number remains at No. 666.

Designed for efficiency in production, the new factory more than doubles Tweco's capacity, according to Ray Townsend, president. New machines have been added, new tools developed and new employees hired for the plant.

* * *

Color-Sound Movie Shows Stud Welding

"SPLIT-SECOND Fastening," a new 18-minute color-sound movie is available from the Nelson Stud Welding Division of Morton Gregory Corp., Lorain, O., for free showings at engineering group meetings. It is currently being shown to about 20 groups per month, according to Leonard C. Barr, Nelson's sales manager and vice-president. The movie shows how stud welding is being used in the construction, railroad, metalworking and other industries.

* * *

Burdett Oxygen Builds Oxygen Plant at Dayton

AN oxygen plant with a capacity of 6,000,000 cu ft per month will be built at Dayton, O., by the Burdett Oxygen Co., of Cleveland. The new plant, representing an investment of $350,000 in land, buildings and equipment, will also serve as a welding equipment sales and repair branch for the Columbus, Springfield, and Cincinnati, areas, according to Burdett's president, William H. Loveman.

* * *

Australian Factory Flash Welds Bathtubs

A SPECIALLY designed flash-butt welding machine, claimed to be the only one in the world, welds apron-type bathtubs at the Commonwealth Aircraft Corporation Pty., Ltd., Melbourne, Australia. The tubs are assembled in the welder and accompanying jigs from five pressed-steel parts 0.08 in. thick. These parts are: a center section, two end bowls and two end flanges.

First assembly step is to flash-butt weld an end bowl to an end flange. The second end bowl and end flange are welded the same way but have lugs oxyacetylene welded to them. The lugs raise this end of the tub slightly off the floor to help drain the tub.

The two bowl assemblies are separately welded to the center section. Corners of the back and end flanges are gas welded after the flanges have been further formed in a folding machine and press brake.

—*McGraw-Hill World News*

A superior PRODUCT AT A competitive PRICE!

Wire in special thread-wound coils for submerged arc welding

Grades Regularly in Stock
"RACO" Mild Steel
"RACO" High Tensile
"RACO" High Mang
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"RACO" Medium Carbon (Surfacing) Wire
Furnished in all standard size thread-wound coils.

YOU profit by these RACO extras: Rigidly inspected high quality steel. Beautiful bright copper coating. All coils uniformly thread-wound and uniform in weight, width, inside and outside diameters to fit your reels. Thread-winding and prebent controlled curvature eliminates unwinding entanglements, waves, kinks. Assures deposition only in welding vee. Assures uninterrupted production.

Wire is drawn, copper coated, and mechanically thread-wound immediately preceding shipment, on machines specially developed by us.

RACO coils are packed and sealed in heavy cartons, and palletized to prevent damage in transit, improper stacking or torn wrappers which result in rust and dirt. Coils are not distorted out of shape by rough handling. Steel-strapped palletized unit-shipments prevent mixing with other consignments at transfer terminals while en route; avoid filing of claims, etc. Fifty-six 25-pound coils, twenty-eight 75-pound coils, eight 150-pound coils per unit pallet at no extra cost to you.

Our special packing and shipping methods reduce your handling, disbursement, and storekeeping costs. Save storage space. Provide easy identification as to type and diameter of wire. Our superior quality and coiling assures superior welds and reduces cost per pound of deposited metal.

The **REID-AVERY COMPANY**
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It is the sales policy of The Reid-Avery Company, Inc., to market our products exclusively through distributors and agents. • *Members of* THE AMERICAN WELDING SOCIETY *and* THE NATIONAL WELDING SUPPLY ASSOCIATION

Commerce Dept. Advises on Production Secrets

NEW service in the Department of Commerce helps guard manufacturers against the release of technological information that might endanger the nation's security. To be operated through the department's Office of Technical Services, the new service will provide a central place to which business executives, local officials, scientific organizations and private citizens may write for guidance on whether to release information not subject to formal security regulations. It is not necessary that the guidance offered be followed.

Types of information over which such voluntary public guardianship is invited technical data on advanced industrial developments, advanced production techniques, strategic equipment, special installations or significant integrations of previously scattered groups of information.

Inquiries may be addressed to the OTS, U. S. Department of Commerce, Washington 25, D. C.

* * *

Airco Oxygen Plant For Butler, Pa.

PURCHASE of a 23-acre site in Butler, Pa., for the erection of a oxygen and nitrogen plant has been announced by the Air Reduction Sales Co. The new plant and facilities, designed by Air Reduction, will be constructed by Koppers Company, Pittsburgh. It is planned to be producing by the end of 1951.

* * *

Montana Oxygen Firm Commences Production

HOME Oxygen Co., Billings, Montana, started producing oxygen and acetylene for the Billings area in December. The warehouse is at 1917 Montana Avenue with the production plant at 1041 Sugar Avenue. Trademark of the firm's gases will be "Homox."

In charge of operations is Robert Hawkins, vice-president. Secretary is A. W. Fletcher. The company will also handle a complete line of welding equipment for both gas and arc welding.

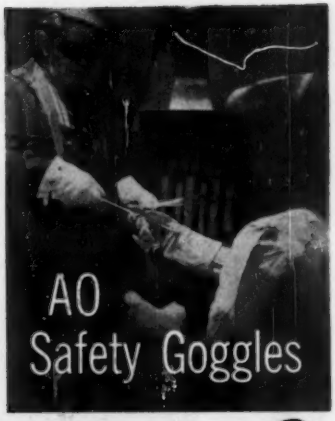
* * *

Wyoming Acetylene Plant Starts Operations

THE Worland Oxygen Co., Worland, Wyo., was scheduled to begin production of oxygen and acetylene soon after Feb. 1, 1951. The company has a new plant with new equipment. Both gas and arc welding supplies and equipment will be sold in the Worland area by the firm.

F. Eldon Cook and Ernest L. Cook will manage the company. Their father, Ernest K. Cook, will retain an interest in the business while operating an automobile agency in Worland.

The Cook family has been engaged in the reselling of oxygen and acetylene for many years.



Be Doubly Safe

from Glare and Impact Hazards with this **STREAMLINED WELDER'S GOGGLE!**

The 3081 goggle is one of AO's latest contributions to welders' safety and comfort. With Calobar lenses, it offers double protection for welders (under helmets), welders' helpers, furnace men, brazers, molders—anyone exposed to both impact and ray-glare hazards. With clear lenses, it is preferred by many for front and side protection against flying particles when chipping, grinding, riveting and spot welding. Features include handsome streamlined styling and light weight. Your nearest AO Safety Products Representative can supply you.

QUICK FACTS

BRIDGE—Sturdy cylinder bridge and reinforcing bar leather-covered to protect against heat, foreign bodies, stray light. 3 bridge sizes.

TEMPLES—On-center. Easily adjusted, perspiration proof and insulated with half tubing that will outlast temple. Dirt, grease can't discolor. Temples and endpiece screws, AO patented "Evertite."

ENDPIECES—Streamlined with wide bearing surface at hinge to minimize temple drop. Screw heads countersunk for non-sagging security.

SIDE SHIELDS—Soft leather type for utmost comfort and protection against lateral striking exposures.

LENSES—Super Armorplate or 6 Curve Super Armorplate Calobar. Medium, dark or extra dark. When injurious light or glare are not hazards, ask for clear Super Armorplate or clear 6 Curve Super Armorplate lenses.

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SAFETY PRODUCTS DIVISION

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Any Type
Any Grade

A complete line of Welding Brushes for ALL types and makes of Welding Equipment —Keen-Arc Carbons for twin-arc torches—carbon and graphite welding electrodes—carbon rods, plates and paste . . . plus the facilities and engineering staff to produce any electrical or mechanical carbons to your specifications. Write for catalogs.

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SILVALOY SILVER BRAZING ALLOYS

The Silvaloy group consists of 7 popular silver brazing alloys high in tensile strength and producing strong, ductile joints on ferrous and non-ferrous metals.

	SILVER CONTENT	MELTING POINT	FLOW POINT
SILVALOY 50	50%	1160 F	1175 F
SILVALOY 45	45%	1125 F	1145 F
SILVALOY 40	40%	1135 F	1205 F
SILVALOY 35	35%	1125 F	1295 F
SILVALOY 20	20%	1430 F	1500 F
SILVALOY 15	15%	1185 F	1280 F
SILVALOY 503	50%	1195 F	1270 F

1200 All-Purpose Flux—for use on all metals. No. 1200 Flux readily dissolves oxides during brazing operations and aids in the flowing of the alloy. Meets all government specifications.

1100 Low Temperature Flux—superior where exceptionally clean surfaces on copper or copper alloys are required at lower temperatures.

COMPLETE STOCKS

Oxy-acetelyne welding rods and flux for cast iron, steel, aluminum, brass, copper, bronze, nickel, monel and inconel.

STEEL SALES CORPORATION

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BRANCH PLANTS: Detroit, St. Louis • **BRANCH OFFICES:** Milwaukee, Minneapolis, Grand Rapids, Indianapolis, Kansas City, Mo.

About People

RAY F. SPARROW has been elected senior vice-president of P. R. Mallory & Co., Inc., Indianapolis. He has been vice-president in charge of Mallory sales since 1931.

* * *

G. E. (George) MAHONEY has been named manager of the Tulsa, Okla., branch office of the Ladish Co., manufacturer of seamless welded pipe fittings. For the past three years he was district manager at Chicago. W. H. HECKENBERG has been appointed district manager of the company's St. Louis office.

* * *

HAROLD NORWAY has returned to the research and development staff of The Bastian-Blessing Co., Chicago. He will work on LP-Gas equipment development. He formerly worked for Bastian-Blessing from 1939 to 1947.

* * *

WILBUR R. LEOPOLD has been appointed assistant to vice-president T. Cruthers of Worthington Pump and Machinery Corp., Harrison, N. J. He was formerly manager of Worthington's Detroit office. CLARENCE S. WENTWORTH will take Mr. Leopold's place in the Detroit position. J. J. THOMPSON has been named manager of the sales personnel and training division of Worthington.

* * *

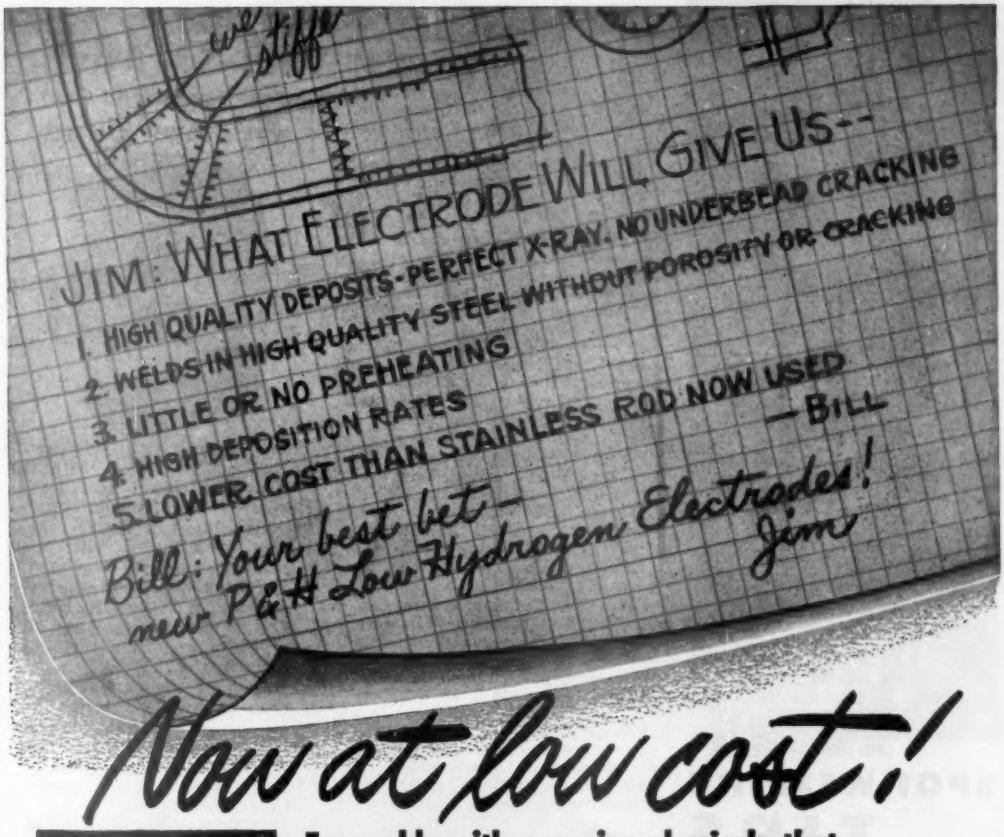
JAMES WILLIAM BROOKS will do sales and engineering work for the Lincoln Electric Company office in Indianapolis. THOMAS L. DEMPSEY is a special field engineer recently added to the staff of Lincoln's Cleveland sales office. He will specialize on redesigning of machinery. JOHN F. KOTCHIAN is serving as a welding engineer with Lincoln's Chicago district. Mr. Kotchian will assist in developing maintenance welding in such service organizations as bakeries, green houses, hospitals, garages and dairies.

* * *

WILLIAM J. FLEMING is vice president in charge of engineering and manufacturing for General Electric X-Ray Corp., Milwaukee. He was transferred from his position as vice-president in charge of engineering at the Trumbull Electric Mfg. Co., Plainville, Conn.

* * *

JOHN F. COSTIGAN has been named assistant works manager of Allis-Chalmers, Norwood, O., works. He was formerly assistant to the general works manager of the general machinery division's manufacturing department.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JIM: WHAT ELECTRODE WILL GIVE US--
1. HIGH QUALITY DEPOSITS-PERFECT X-RAY, NO UNDERBEAD CRACKING
2. WELDS IN HIGH QUALITY STEEL WITHOUT POROSITY OR CRACKING
3. LITTLE OR NO PREHEATING
4. HIGH DEPOSITION RATES
5. LOWER COST THAN STAINLESS ROD NOW USED
—BILL
Bill: Your best bet—
new P&H Low Hydrogen Electrodes!
Jim

Now at low cost!

P&H

For welds with superior physicals that match special steels, simplify production— —

LOW HYDROGEN ELECTRODES

Here's the world's most complete line of low hydrogen electrodes — 14 types to choose from.

Operators prefer them because of their easy manipulation, easy slag removal, smoother deposit, low spatter loss, fast deposit rate, good penetration, and less smoke.

Manufacturers prefer them too. They have fewer rejections. Smaller welds for faster production. Fewer types of rods to buy, stock, and supervise. They eliminate trouble with off-analysis steel.

Simplify your welding procedures. Standardize on P&H Low Hydrogen Electrodes. Your costs are lower, your welds better and stronger.

P&H WELDING DIVISION
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Milwaukee 14, Wisconsin
HARNISCHFEGER CORPORATION

2255

Here are a few of the money-saving P&H Low Hydrogen Electrodes:

- *For problem steels:* High carbon, high sulphur, cold-rolled alloy . . . 70LA and 70LA-2.
- *For steel castings repair;* matches analysis and heat-treating properties of Grade B castings . . . P&H .25C.
- *For steel castings repair;* matches heat treating properties of Grade B castings . . . 70LB.
- *For welding nickel-alloy steels;* gives high impact resistance at low temperatures . . . 75LP.
- *For Chrome-moly steels* (1% Cr., ½% Mo.) used in power piping . . . 80LE.
- *For Chrome-moly steels* (2¼ Cr., 1% Mo.) used in power piping . . . 90LE.
- *To match heat-treating properties of SAE 1040* and like steels. Also for steel-castings repair . . . P&H .40C.
- *For welding high hardenable steels.* Also steel castings repair . . . AW2B.
- *For repair welding Grade C castings* and steels of similar composition . . . P&H-7.
- *Comparable to SAE 8630 steel* . . . excellent heat-treating and flame-hardening characteristics . . . 90LH-2.
- *For welding high hardenable steels* without pre-heat such as re-rolled rail stock . . . P&H-12 and P&H-17.
- *For aircraft and similar steels* . . . has wide range of properties under heat treatments . . . P&H-21.

Excavators • Overhead Cranes • Hoists • Arc Welders and Electrodes • Soil Stabilizers • Crawler and Truck Cranes • Diesel Engines
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SPOT WELDING TIPS

Resistance Welding knows this symbol. In shops small and large, it means *dependability* in Tips for sound, clean welds—efficient cooling—speedy welding—long tip life—less down time—welding at a saving!

WW Tips are made of alloys of correct physical and electrical properties, precision-machined, water-tight and electrically tight fitting.

Replaceable tips, both straight and offset, WW leak-proof holders, seam welding wheels, electrodes and dies and special alloys for making your own dies are available in numerous standard sizes which you will find in the WW Catalog entitled "Standard Replaceable Welding Tips—Standard Water-Cooled Holders." Weiger Weed & Company, Division of Fansteel Metallurgical Corporation, 11644 Cloverdale Avenue, Detroit 4, Michigan.

Send for this free booklet of latest information on Resistance Welding.

NICHOLAS M. DUCHEMIN, Lynn Field, Mass., and JOHN W. BELANGER, Schenectady, N. Y., have been named general managers of the Small Apparatus Divisions and Large Apparatus Divisions, respectively, of the General Electric Company's Apparatus Department. Both were formerly assistant general managers of the department. The welding division is included in the Small Apparatus Division.

* * *

W. R. PERSONS has been elected vice-president in charge of sales of The Lincoln Electric Co., Cleveland. He was formerly general sales manager. He has been with Lincoln since 1934. In 1946 he made for Lincoln an extensive survey of the agricultural economy of the United States and planned an approach to the sale of welding equipment in this market. He is a member of The American Welding Society.

* * *

L. V. JOHNSON has been named chief engineer of the National Tube company, U. S. Steel subsidiary. He will take over duties handled by JOHN L. YOUNG, newly elected vice-president-chief engineer of United States Steel company.

* * *

CHARLES W. JINNETTE, Norton Company's regional manager of business planning and development, retired in December after 50½ years of active service with the company. He started in June, 1900, at $3.50 for a 54-hour week as office and errand boy. During his long career he helped develop abrasive manufacturing techniques, and the promotion of boron carbide abrasives, ceramic surfaces plates and ceramics as wear-resistant materials.

* * *

FRANK HALLBERG has been appointed chief engineer of the Ross Operating Valve Co., Detroit. For a number of years he was a design engineer for the Progressive Welder Co., Detroit, and the Federal Machine and Welder Co., Warren, O.

* * *

CAPTAIN DAVID R. HULL, USN (Ret.) has been elected a vice-president of Raytheon Mfg. Co., Waltham, Mass. For ten years before World War II, he specialized in underwater sound and radar development. He was advanced to the post of assistant Chief of the Bureau of Ships for electronics, the senior Navy position in electronics.

* * *

HAROLD B. WISHART has been named chief metallurgist of the Gary Steel works of Carnegie-Illinois Steel Corp. He succeeds OSCAR PEARSON, recently advanced to division superintendent of the plant's steel production.

* * *

Died . . .

JOSEPH J. CHARVAT, vice-president of Brooks Steel Products, Inc., Chicago, passed away on Dec. 12.

Sel-O-Matic

Adjustable Head Gear

Fits Any Head

This is a comparatively new Sellstrom Welding Helmet "Adjustable" Head Gear.

Here are a few of the outstanding advantages it offers:

1. Can be **adjusted with one hand** while helmet is on head.
2. Once adjusted, it **remains secure** unless changed by hand.
3. Can be **used with any and all styles** of Sellstrom Welding Helmets.
4. Any **worn part can easily be replaced** by the welder.
5. So far as we know, this is the only headgear with the **"teeth" cut in a specially tough fibre,** water or moisture resistant.
6. This fibre of specially tough material is unusually strong and **permanently keeps its shape.**
7. The adjusting **section and knob** is made **of strong plastic.**
8. The three round knob holes in the band give the headgear three sets of teeth and permit the Sellstrom "Sel-O-Matic" to **outlast any other similar headgear."**
9. The headgear is equipped with a **standard top grain genuine leather sweat band** and is kept in place by four glove fasteners.

Ask your dealer to show you this new "Sel-O-Matic" Headgear, or write us for complete information.

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More Than 200 Eye and Face Safeguards

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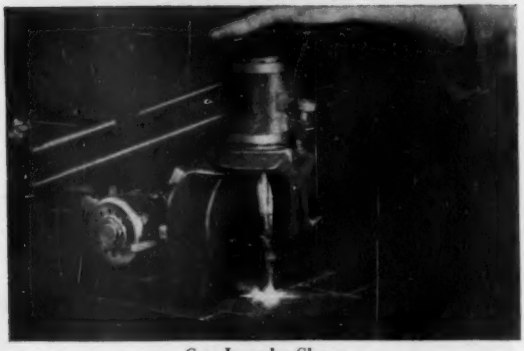
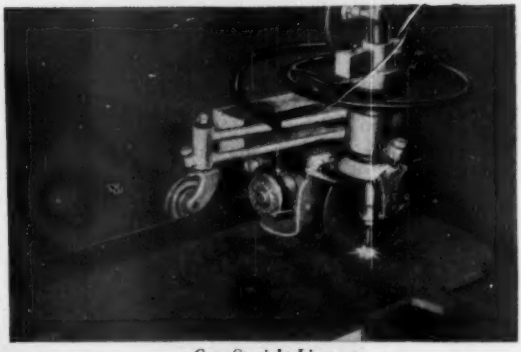


Cuts Irregular Shapes



Cuts Straight Lines

Cuts Circles

In large and small shops alike, the OXWELD CM-16 Portable Cutting Machine fills an unbelievably wide variety of oxygen cutting requirements. It cuts circles automatically. Hand-guided, it cuts irregular shapes. Operated on track, it cuts straight lines.

Indoors or out—wherever steel needs shaping—the CM-16 makes it easy to "tailor" parts as fast as the work can be laid out. *And its ready adaptability for special jobs is limited only by its operator's ingenuity!*

The CM-16 sets up as quickly as any manual outfit. It weighs only 45 lb., travels directly on the work, and is easy to carry from job to job. In normal use, it cuts up to 4 in. of steel; with standard accessories, it cuts materials up to 18 in. thick and it cuts bevels.

Any LINDE representative will be glad to show you how the OXWELD CM-16 Portable Cutting Machine can boost production and cut fabricating costs in your shop. Write for catalog, Form 4487, or call the LINDE Office nearest you today for a free demonstration.

The terms "Linde" and "Oxweld" are registered trade-marks of Union Carbide and Carbon Corporation.

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Oxweld Trade-Mark **CM-16 PORTABLE CUTTING MACHINE**

"CAN YOU RECOMMEND A STEEL SUPPLIER WHO HAS GOOD FACILITIES FOR FLAME-CUTTING PLATES?"
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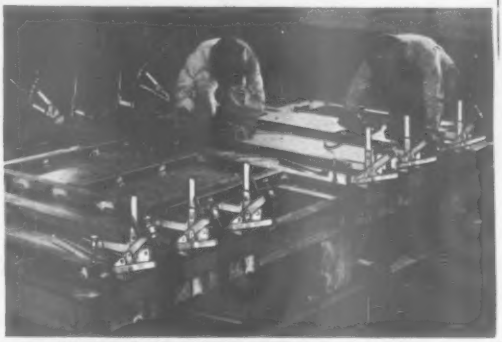
UNITED STATES STEEL

Production Welders Locate and HOLD with "DE-STA-CO" clamps



Revised 32-page catalog of toggle clamps, accessories, applications. Template sheets for efficient fixture design.

Precision clamp manufacture and high holding-pressures are the "secret" of this efficient welding fixture. Locating pins welded to clamp bars hold channels in positions to weld variable length assemblies in this versatile fixture. "De-Sta-Co" reamed holes and hardened pins assure accurate positioning of parts. Positive holding pressure forces cross members and plates into close contact essential for strong production welding. And "De-Sta-Co" quick toggle action makes loading a job untrained workers, even women operators, handle with ease, in seconds.

More than forty "De-Sta-Co" models—including new portable and plunger clamps—offer quick solutions to your locating and holding problems. The "De-Sta-Co" stocking distributor in your area is qualified to assist you; call him in, or, if you haven't met him, write for his name and your copy of our catalog, today.

DETROIT STAMPING COMPANY

372 MIDLAND AVE. • DETROIT 3, MICHIGAN

30 YEARS AGO

(From THE WELDING ENGINEER of Feb., 1921)

SIGN OF PROHIBITION times: "Our idea of an optimist is the fellow who still carries a corkscrew." *Display line in the current advertisement of the Kentucky Oxygen-Hydrogen Co., Louisville, Ky.*

—30 YEARS AGO—

FLAME-CUTTING holes in concrete beats the star drill and sledge hammer style, reports B. A. Johnson of Minot, N. D. He uses a No. 10 tip with a standard cutting torch. Recently he cut 12 holes through a 12-in. concrete floor in two hours, for an average of 10 minutes per hole. Pebbles and stones in the concrete crack readily as the oxy-acetylene flames hits them, Mr. Johnson says. He advises that operators wear some protection against the flying pieces of concrete.

—30 YEARS AGO—

SUPER-SIZE risers in large foundries pose extreme flame-cutting problems. An air compressor casting poured at large eastern foundry weighed 90 tons with riser, core and mould. The riser was 5½ ft in diameter, 4 ft long and had 15-in. walls. It was necessary to use two oxygen cylinders in manifold and the heaviest model cutting torch. Cutting time was about 20 hours. Some 7,250 cu ft of oxygen were burned to make the 25¼ ft of cut.

—30 YEARS AGO—

TESTING of welds receives increased attention lately and indicates a nation-wide interest in the fabrication possibilities of welding. One testing report made by the American Welding Society was reprinted in 20 of the country's leading business papers and three European magazines.

—30 YEARS AGO—

REMOVING "hammers" and "tramp iron" from copper ore in ore crushers is best done with the oxyacetylene cutting torch, according to the Engels Copper Mining Co., Engelmine, Calif. Much costly damage to the crushing equipment is avoided in a cheap and efficient way.

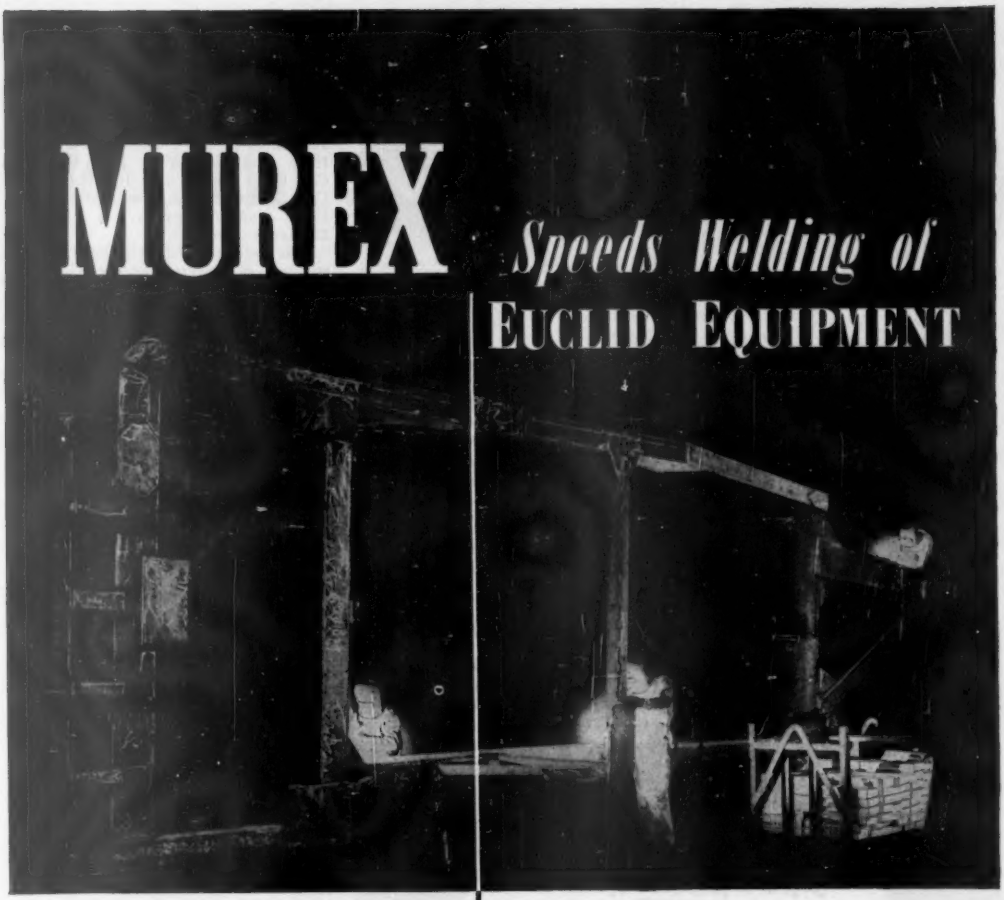
—30 YEARS AGO—

HAND shields, goggles and protective helmets for welding and cutting are reviewed in the lead article of THE WELDING ENGINEER this month by William Spraragen, secretary of the Engineering Division, National Research Council.

—30 YEARS AGO—

SCHENECTADY section of the American Welding Society was organized recently with about 30 members. Membership is expected to rise to 50 or 75. The Schenectady constitution and by-laws will be patterned after those adopted by the Philadelphia and Metropolitan sections.

MUREX *Speeds Welding of* EUCLID EQUIPMENT



MUREX

Fast, easy-to-use, Murex Genex electrodes speed production of welded frames for heavy duty earth moving equipment built by The Euclid Road Machinery Co. And, their nearly spatter-free operation reduces weld cleaning time to a minimum.

Many of America's leading fabricators have standardized on Murex electrodes because of their ability to provide high quality welds at low cost. Let us put you in touch with Murex performance today. Descriptive literature—yours for the asking.

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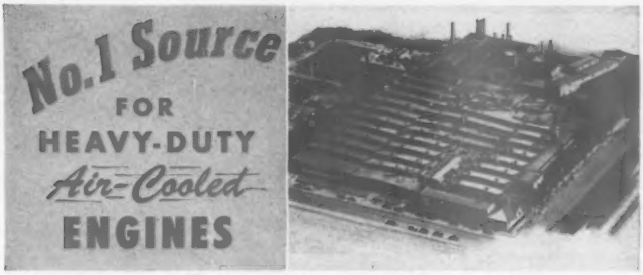

4-cycle
Single Cyl.
3 to 9 hp.

4-cycle
2-Cyl.
7 to 13 hp.

V-type
4-Cyl.
15 to 30 hp.

As a potential or present user of internal combustion engines, you will readily recognize the advantages of dealing with an outstanding leader in this field.

Because constant engineering effort and manufacturing skill are applied entirely to the improvement and large volume production of WISCONSIN HEAVY-DUTY AIR-COOLED ENGINES, in a complete, all-purpose power range, you have the best assurance not only of dependable power units ideally suited to your power applications but, of equal importance . . . you have, here, the world's most dependable source of supply both for engines and original factory parts.

Supporting this endeavor are key distributors of impressive recognition in the territories they serve, and a staff of competent Wisconsin Motor Corporation field men, in close liaison between factory and customer. Your best interests are our primary interest.

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SAVE TACKING TIME!
Quick-acting, positive Danly KWIK KLAMPS hold pieces firmly in place for welding . . . clamping pressures up to 750 pounds maintain precision alignment. A single motion of the lever handle clamps or releases the work, saving precious production hours.
Available in 26 sizes and a wide variety of designs, KWIK KLAMPS suit almost every application. Select the style and size for your use from the booklet illustrated below.
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Book Reviews

Dictionary

WELDING DICTIONARY: FRENCH—GERMAN—SPANISH—ENGLISH. Compiled and edited by R. N. Thompson and G. Haim. Published by The Louis Cassier Co., Ltd., London and distributed in U. S. by British Book Centre, New York 1950. Simulated leather, 5 x 7½ in.; 234 pages. Price $3.

This dictionary will help the welding engineer or research worker who already has a working knowledge of French, German or Spanish to more easily understand the technical publications pertaining to welding.

The dictionary is divided into four parts: French, German, Spanish and English. The English part, however, is treated as a key glossary—look up a word in English and you can read its equivalent in the other three languages.

Besides terms specifically related to welding, expressions pertaining to electrical and mechanical engineering and to metallurgy are also included. The ready translation of such terms is essential in order to understand any welding literature in a foreign language.

* * *

Safety Standard

SAFETY IN ELECTRIC AND GAS WELDING AND CUTTING OPERATIONS. Published by American Welding Society, New York, 1950. Paper, 6 x 9 in., 44 pages. Prive 50 cents.

Based on standards of safety developed during World War II, an American Standard has been prepared to cover welding. The eight sections into which this standard is divided cover: (1) scope of the standard, (2) definition of terms, (3) installation and operation of arc welding, (4) installation and operation of gas welding and cutting, (5) installation and operation of resistancme welding, (6) fire prevention and protection, (7) protection of personnel, (8) ventilation and health protection.

A bibliography lists most of the codes, standards and books of safety pertaining to welding.

* * *

Bridges

WELDED DECK HIGHWAY BRIDGES. Edited by James G. Clark. Published by James F. Lincoln Arc Welding Foundation, Cleveland 1951. Cloth, 5½ x 8½ in.; 247 pages. Price $2.

The James F. Lincoln Foundation sponsored a "Welded Bridge of the Future" award program in 1949. Best material submitted in this program has now been compiled in one volume. The ideas presented are those of the foremost bridge designers and fabricators; their subject is the best way to make an all-welded, 120-ft deck highway bridge. Their thoughts on design, fabricating and erecting steel structures and other details look forward to

Welding Monel-Clad Steel?

"140"s are right!

If you are doing any of the following jobs, Inco's *"140" Monel* electrode is the one to use:

1. Welding the clad side of Monel-Clad Steel.
2. Overlaying Monel on steel.
3. Joining wrought or cast Monel and nickel to steel and stainless steel.

The *"140" Monel* electrode has a special low-carbon flux coating which enables you to make crack-free deposits of Monel® directly on steel.

For special applications, the *"140" Monel* electrode offers other important advantages:

- Eliminates the need for a seal bead of nickel in welding the clad side of Monel-Clad Steel.
- Eliminates need for a barrier layer of nickel weld metal between steel and Monel overlays.
- *"140"* welds have corrosion resistance and physical properties comparable to solid Monel.

Although not recommended specifically for that purpose, *"140" Monel* electrodes may be used to weld solid Monel in place of the standard *"130X" Monel* electrode.

Because of the heavy demands being made on our resources by the national rearmament program, you may not be able to get all the Inco welding materials you need. If you encounter problems in welding any of the Inco Nickel Alloys, remember that Inco's Technical Service Department is always ready to assist you.

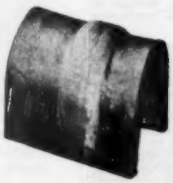
Technical Data for
"140" MONEL ELECTRODES

***Current requirements:* D.C., reversed polarity**

3/32"	dia. —	35 - 60 amps.
1/8"	dia. —	70 - 110 amps.
5/32"	dia. —	110 - 150 amps.
3/16"	dia. —	140 - 190 amps.

Properties of welds:

Joint	Tensile P. S. I.	% Elong.
Monel to mild steel	70,100	45
Nickel to mild steel	64,600	49
Monel to Type 316 stainless	87,800	44
Monel to Type 347 stainless	81,100	48



Guided bend test specimen of welded overlay made with new "140" Monel electrode directly on 3" by 6" by 3/8" steel plate. Note the excellent ductility and adherence of the deposit.

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THE
ARC-FIT
PROCESS
Patented
Tube notched with special ARC-FIT
Angular notch on tubular member.
Square tube notched to fit square pipe.
Angle joint on two pipes.
"T" notch on end of Tubular member.
Pipe Notched with deep slot.
"T" joint on tube or pipe.
Angle iron notched to fit pipe.

TOPS IN SHOP EFFICIENCY

5 seconds to notch Tubing and Pipe Ends

The answer to many problems confronting large and small shop owners. No shop can afford to be without the ARC-FIT—no matter how large or how small. Manual or power operated—fits the ARC-FIT hand press or any standard power press.

ARC-FIT is a patented precision-built shearing tool which prepares the ends of tubing or pipe to produce welded or brazed tubular "T" or angle joints. ARC-FIT will not deform the tube or pipe and no further finishing is required—no sawing, cutting, or removing sections with milling cutters. Our literature gives many fine points on operation, construction, and application—send for it today —also write for quotations.

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the future, making this book one of great interest and value for all persons working with steel structures. It will serve as a source of both design ideas and of practical shop and field suggestions.

The book's five chapters cover structural types, floor systems, new sections, special connections and details and quantity and costs. Every effort was made to insure that most of the new and important ideas presented in the award program would be included.

* * *

Formulas

CHEMICAL FORMULARY, Vol. IX. Edited by H. Bennett. Published by Chemical Publishing Co., Inc., Brooklyn, 1951. Cloth, 5½ x 8½ in., 648 pages. Price $7.

This volume is number 9 of the well known chemical formulary series, and supplements previous volumes by presenting the latest developments in each of the fields covered.

Readers of THE WELDING ENGINEER will be particularly interested in Chapter 12, which devotes 83 pages to metals and their treatment. Most of the material deals with plating and finishing applications; however, there are several pages on soldering, solder compounds and fluxes and six formulas for welding electrode coatings and fluxes. Several brazing compound formulas are also given.

Of particular value is a listing of chemical trade marks and chemical supplies.

This book covers practically all fields where basic products are manufactured requiring the use of chemicals. Examples of such products covered are: cosmetics and drugs; ceramics, cement and glass; ink and marking compounds; lubricants and oils; paint, varnish, lacquer and other coatings; polishes; soaps and cleaners.

* * *

Management

THE FOREMAN'S PRODUCTION JOB. By A. I. Kress and T. O. Armstrong. Published by National Foreman's Institute, Inc., New London, Conn., 1951. Cloth, 5¼ x 8 in.; 152 pages. Price $2.50.

Mr. Kress's opening section. "Factory Management and the Foreman," outlines how the modern factory looks and how it operates. The part of the foreman in factory operation is stressed. The reader is then taken on a tour of the various staff and line departments to see where they should fit into the picture. The foreman is shown in his relationship with each department. The foreman's part in the problems of maintenance, production control, methods, quality control and results and measurements is also covered.

Co-author Armstrong prepared the second part of the book, "A Check List for Effective Foremanship." Here are developed systems and check lists by which the foreman can achieve the standards set up in the first section

Gyratory Crushers
with
MANGANAL
U.S. Patents 1,876,738 - 1,947,167 - 2,021,945

11% to 13½%
Manganese-Nickel Steel
ROUND APPLICATOR BARS

- **SPEED REPAIRS** . . . replace worn metal faster, more economically with **MANGANAL** Round Applicator Bars.
- **GYRATORY CRUSHERS** rebuilt with Manganal often outlast new ones.
- **ELEVEN SIZES** of **MANGANAL** Round Applicator Bars are available for all degrees of wear . . . attach with **MANGANAL** Bare or Special Tite-Kote Electrodes for greatest strength and longest wear.
- **MANGANAL** workhardens under impact and abrasion to 550 Brinell . . . tensile strength up to 150,000 p.s.i.

FREE—Informative literature outlining newest methods for speedy and economical repair of worn equipment.

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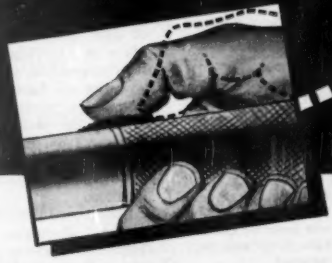
2. You save time by eliminating constant lighting, flame adjusting and Torch shut off. This adds materially to output of work.
3. You make life easier for the torch operator. A single quarter-inch movement of the thumb accomplishes the same result as a dozen or more motions, involving both hands.
4. You bring your operations up-to-date by as big an improvement as that made when self starters were added to automobiles — more so, in fact, since the Harris Automatic Torch repays its entire cost many times over in cash savings.
5. When you next see a torch burning, without being applied to work, decide to DO something about it! Contact the nearest Harris Exclusive Distributor, located in principal Cities. Better yet, do it now.



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SERVING THE METAL INDUSTRY SINCE 1905

a double-duty torch for your light welding and cutting

The "Jet" is as new and different as its name implies... designed for two operations from a single torch. It consists of two units, with the cutting attachment identical to that used with the famous WELDMASTER Torch, scaled down for lighter duty. For precision work with an eye on economy—*you'll want* the new MECO Aviator Jet.

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Specify CMD **CHIPPING HAMMERS**

—The Finest Tools Made for EVERY Weld Cleaning Need

TYPE CB . . . A favorite for many years, this hammer is 3 tools in 1—drift, chisel, and removable wire brush.

TYPE A . . . Drift and chisel of high-grade steel. Popular in malleable and grey iron foundries.

TYPES EB and **FB** . . . models E and F can be supplied with brush as shown here. Brush can be replaced.

TYPE E . . . head of high-grade steel has drift and chisel. Special hand grip absorbs shock.

Order from your dealer. Write today for descriptive circular 2-W.

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of the book. Points covered include organization and production responsibility, quality standards, incentive plans, accident prevention, industrial relations and grievances.

The author claims 90% of employee grievances can be foreseen and prevented.

* * *

Management

THE FOREMAN'S MANPOWER JOB. By John E. Gagnon and R. E. Verney. Published by National Foreman's Institute, Inc., New London, Conn., 1950. Cloth, 5¼ x 8 in.; 188 pages. Price $2.50.

Mr. Gagnon takes the first part of this volume. Under the title of "Manpower Management," he deals with a brief history of the foreman's job in industry with respect to manpower. Separate chapters are given to such subjects as selection, placement, training, orientation, promotions, transfers, layoffs, etc. The author also outlines practical safety, health and welfare programs and explains the foreman's responsibility toward each.

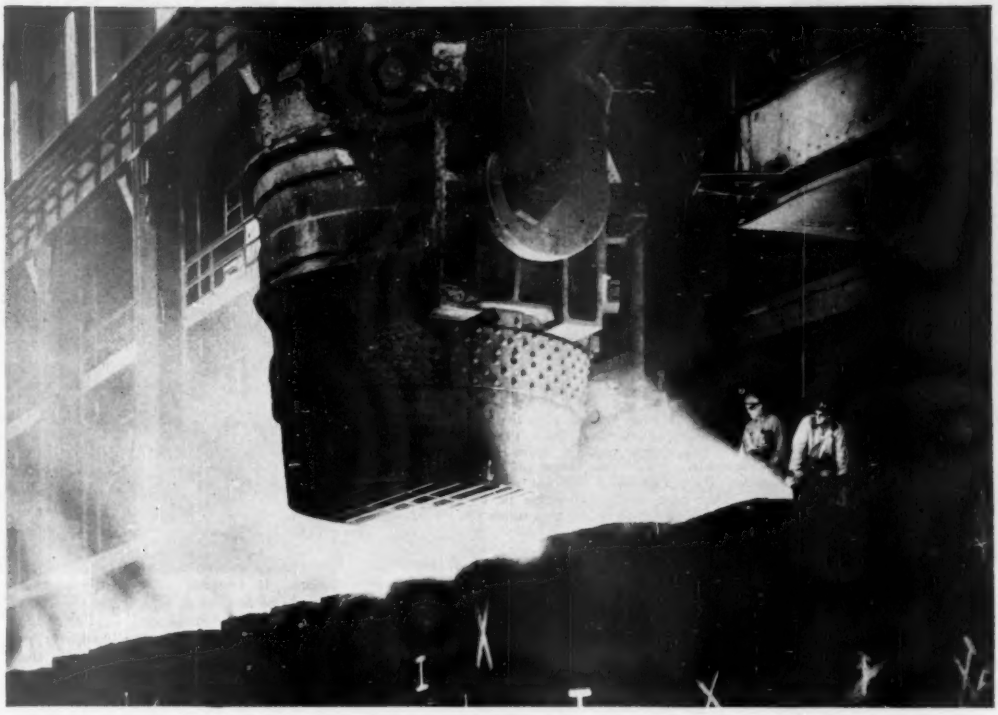
"On-the-Job Manpower Management" is the second section of the book. In this, Author Verney assumes the role of foreman and speaks directly to the reader. He describes various types of supervision (giving the foreman a checklist of four undesirable, negative types) and offers the four basic principles of good supervision. An analytical discussion of how the supervisor can handle his strong and weak points recognizes that it is impossible for any one man to be perfect in all phases of manpower management. Yet he can recognize and work at all phases.

* * *

THE FOREMAN'S PLACE IN MANAGEMENT. By T. G. Newton and Bleick von Bleicken. Published by National Foremen's Institute, Inc., New London, Conn., 1950. Cloth, 5¼ x 8 in., 150 pages. Price $2.50.

Mr. Newton's part of the book is entitled "Professional Foremanship." The author definies in detail the lines of duty with respect to the foreman's place in carrying out the various factors involved in production. He shows how five of America's most successful companies, mentioned by name, have handled the problems of converting the foreman from the role of "gang supervisor" to a managerial supervisor. The basic steps in such a transition fully outlined.

Bleick von Bleicken, in the second section, discusses "The Foreman's Human Relations Job." The author gives a thorough discussion of the problems involved in human relations and how they may be solved. The reader gets an understandable picture of both management and labor's side of the subject. Definite conclusions are drawn as to how and why human relations problems should be practiced of making a working team of management and labor.



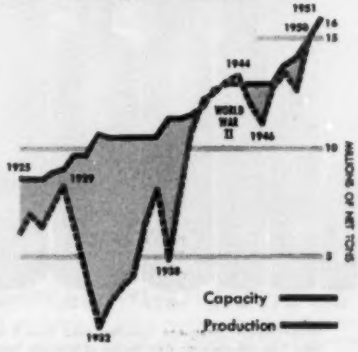
MILLION TONS MORE STEEL

Latest Increase in Bethlehem's Annual Capacity Climaxes 5 Years of Postwar 3,100,000-Ton Expansion

On January 1 of this year Bethlehem's steel making capacity stood at 16 million ingot-tons annually—*an increase of 1 million tons* over a year ago.

Since the war ended we have increased our annual steelmaking capacity *3,100,000 tons, or 24 per cent.*

Moreover, as the chart at the right shows, Bethlehem's steel capacity has nearly doubled in 25 years. Additional capacity can and will be created as it is needed.



BETHLEHEM STEEL ★ BETHLEHEM STEEL ★

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You speed up welding—and save up to 85% of weld cleaning time and labor—when you apply Protect-O-Metal No. 2 before welding. Just brush or spray it in weld seam and adjacent metal—weld—then whisk off spatter in a matter of seconds. Protect-O-Metal will not cause smoke, fumes or odors. One coat serves for single or multi-pass welding. Costs 1/10c per foot of weld, saves up to three times its cost in time savings alone.

Order a trial gallon ($3.25) satisfaction guaranteed or invoice will be cancelled.

PROTECT-O-METAL

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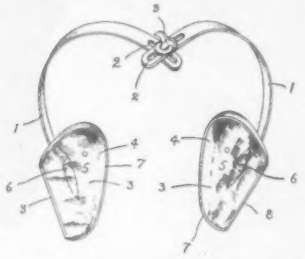
From the Patent Office

Weldor's Ear Guard

2,532,852. VERN GEORGE OAKS, Superior, Wis. Filed Oct. 13, 1947. Granted Dec. 5, 1950.

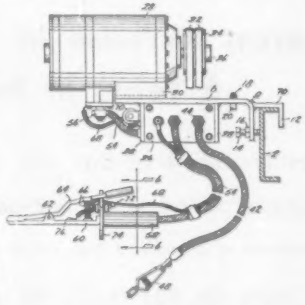


Patent covers a guard for weldors' ears. It consists of a body portion made of fine mesh screen having a flat side surface. A formed leading edge and flanges project inwardly to overlap the ear. A connecting frame holds the guards in place over the ears.

* * *

Portable Arc Welder

2,530,487. KEITH THORNDYKE, Pipestone, Minn. Filed May 4, 1948. Granted Nov. 21, 1950.



Patent covers a mounting for carrying welders on trucks or other vehicles with side beams. A lengthwise base plate is horizontally positioned. It has an inner downward flange on one end and a second downwardly extended flange extended from the end of the base plate, parallel to the first flange and spaced from it. Adjusting screws are threaded in the inner flange of the base plate and act with the second flange to clamp the mounting on a side beam of the vehicle chassis. A welder is mounted on the base plate which also carries a reactor coil. One side of the base plate has a face plate with a number of terminals as shown.

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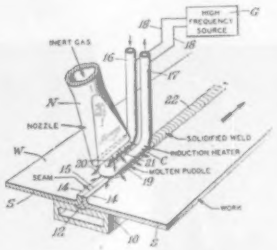
Gas-Shielded Induction Welding

2,528,758. Barnwell R. King, Flushing, N. Y. Assigned to The Linde Air Products Co., Filed July 10, 1948. Granted Nov. 7, 1950.



Patent covers a process of inert-gas-shielded induction fusion welding. It includes positioning of workpieces to be welded, directing a stream of inert gas (from argon or helium group) against the seam and inducing a high-frequency current in the joint of sufficient heat to melt the metal. The relatively small pool of molten metal is protected from the atmosphere by the inert gas. After removing the inert gas and the induced h-f current, the molten metal hardens to integrally unite the workpieces.

* * *

Venting Plug for Electrode

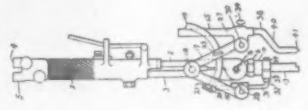
2,531,005. Belmont D. Smith, Eaton, O. Filed Dec. 12, 1949. Granted Nov. 21, 1950.

Patent refers to a hollow electrode that contains an alloying filler. A coat of welding flux is on the outer surface of the electrode. A plug at the open end of the electrode has a vent for releasing gases from the inside of the electrode when it is heated.

* * *

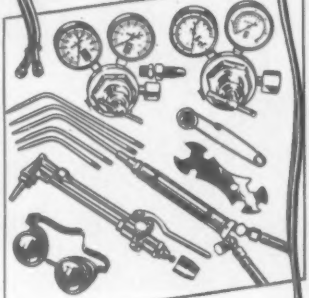
Cutting Torch Attachment

2,524,098. Nils H. Christenson, Wyoming, O. Filed Dec. 14, 1945. Granted Oct. 3, 1950.



For making accurately curved lines around a pivot point, a new patented trammeler attachment includes arms pivoted at one end, a rod holder pivotally connected at the free end of each arm, a socket in each of the holders and a rod slidably adjustable in each socket. The rods are fastened in position in the sockets. The clamp on one of the rods attaches the unit to the cutting torch.

FOR
OXY-ACETYLENE
WELDING and
CUTTING



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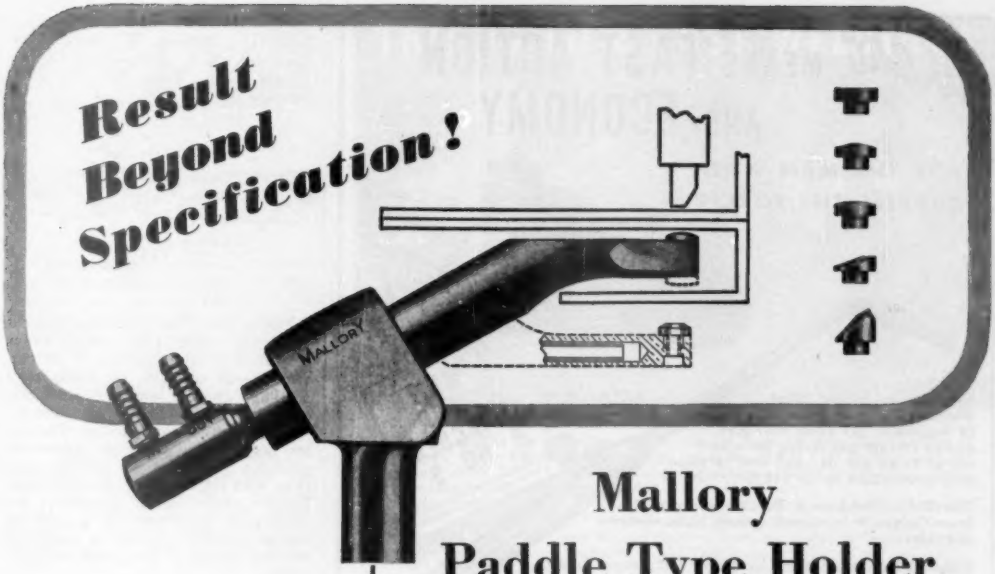

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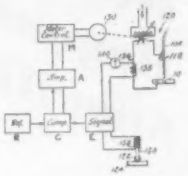
Arc Welding Control

2,529,111. ARTHUR W. STEINBERGER, Elizabeth, N. J. Assigned to Curtiss-Wright Corp., Filed Feb. 19, 1947. Granted Nov. 7, 1950.

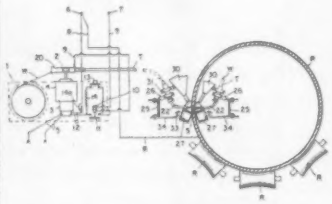


Patent refers to a welding current regulating system. This includes means responsive to the magnitude of the current, means operable according to a welding schedule and means jointly controlled by the current-responsive device and the schedule means. The latter combination of means selectively produces alternate sense control quantities with respect to a reference value. Further means thereby controlled, according to the sense of a selected control quantity, control the supply of welding current at the proper schedule value.

* * *

Automatic Pipe Welding

2,529,812. VLADIMIR PETERS, Lakewood, O. Assigned to The Lincoln Electric Co., Cleveland. Filed June 5, 1948. Granted Nov. 14, 1950.



Newly patented method of automatically welding piping consists first of positioning the metal edges in proper spacing. Next, the weld seam is simultaneously traversed by two arcs, one on each side of the seam (see above). Filler metal is fed into the seam from opposite sides in amount about equal to filling the joint. The arcs are of sufficient intensity to fuse the seam to more than half its depth whereby a common pool of molten metal is formed by their joint action.

* * *

Welding Clamp

2,530,969. ROBERT A. JOHNSON, Longmeadow, Mass.; Effie B. Johnson, executrix of said Robert A. Johnson, deceased. Assigned to Westfield Metal Products Co., Inc., Westfield, Mass. Filed July 21, 1948. Granted Nov. 21, 1950.

Patent covers a new clamp for holding bar stock in welding position.

Liquid-Cooled Welding Cable

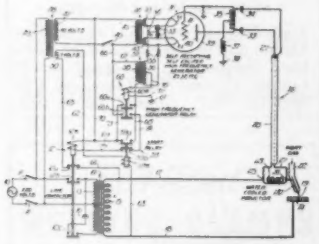
2,535,187. NELSON E. ANDERSON, Scotch Plains, and STEPHEN L. SULLIVAN, Red Bank, N. J. Assigned to Air Reduction Co., New York City. Filed Oct. 29, 1947. Granted Dec. 26, 1950.

Patent covers a cable for arc welding equipment that includes two flexible tubes twisted about each other longitudinally of the cable. A braid of conducting metal carries the current. A casting of flexible material encloses both braid and twisted tubes to afford a space for cooling water.

* * *

Arc Welding Electrode

2,532,807. DEAN C. GIRARD, San Leandro, and Frank T. Roach, Hayward, Calif. Assigned by mesne assignments to National Cylinder Gas Co. Filed Dec. 29, 1948. Granted Dec. 5, 1950.

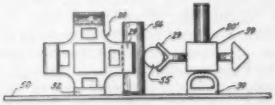


Patent refers to an inductor for use in an arc welding system wherein the arc is a low frequency alternating current and is stabilized by high frequency current of the order of several megacycles superimposed thereon, an inductor is as close to the arc as it is physically possible to position it. Circuit means consist of a non-radiating transmission line for connecting the inductor for energization across the h-f current source.

* * *

Welding Work Holder

2,524,969. CHARLES F. FAIRCHILD, Fulton, Mo. Filed Oct. 3, 1947. Granted Oct. 10, 1950.



Patent covers a weldor's work holder that has a flat web with four projecting arms. Attached to one arm is a plate-like support. In conjunction with sliding rods and V-shaped holders, workpieces are secured.

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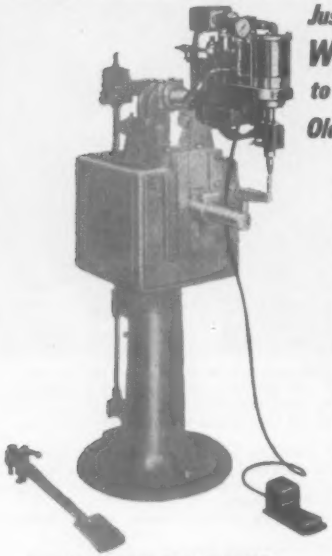

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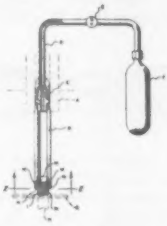
Gas-Cooled Spot Welding Tip

2,536,726. Leo W. Cornwall, San Diego, Calif. Filed Aug. 16, 1949. Granted Jan. 2, 1951.

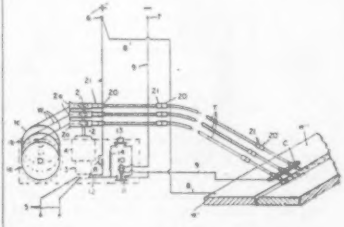


Newly patented gas-cooled spot welding tip has a hollow portion at its inner end to receive gas. At the opposite end of the tip is a welding nib of circular cross section. A number of passages extend from the hollow portion next to the outer peripheral side of the welding nib. The tip is provided with an annular groove communicating with the passages and surrounding the welding nib.

* * *

Automatic Arc Welding

2,536,294. George G. Landis, South Euclid, and Norman J. Hoenie, Cleveland Heights, O. Assigned to The Lincoln Electric Co., Cleveland. Filed May 22, 1947. Granted Jan. 2, 1951.



Patent refers to an arc welding system having a continuous metallic electrode upon which is imposed a high-density welding current. Welding current leads are directly connected to the electrode and to the work. Connection of the lead for the electrode is very close to the end having the arc. An electric motor drives the electrode feeding means. The motor has its field connected with an independent and fixed source of voltage. Its armature is connected across the welding current leads. The operation of the motor in feeding the electrode is thus independent of any traversing movement of the electrode relatively to the work. The flow of welding current through the leads is solely controlled during welding by making and breaking contact between the arc-end of the electrode and the work. A relay switch is operable by the current in one of the leads and is adapted to make and break the supply of current to the armature of the motor.

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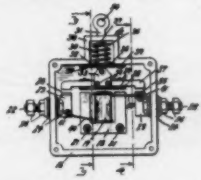
Engine-Driven Welder Control

2,524,257. CHARLES J. HARRAH, Denver, Colo. Filed July 21, 1947. Granted Oct. 3, 1950.

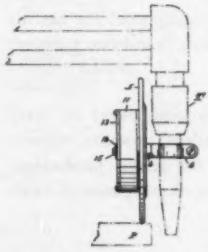


A recently patented control for engine-driven welders combines a circuit closer and a throttle-opening device. It includes a housing with electric terminals on opposite sides. A movable switch bar is positioned to extend from one terminal to the other. A solenoid is mounted next to the switch bar so as to attract it into contact with the terminal. Conductors connect the solenoid in series with the two terminals. A plunger extends into the housing. A pivotal connection between the switch bar and the plunger relays the movements of the former to the latter. Spring means move the plunger outwardly to withdraw the switch from the contacts. Connecting members join the plunger to the engine throttle. The contacts are in circuit with a generator.

* * *

Cutting Torch Attachment

2,525,241. WALTER F. RENTSCH, San Francisco, Calif. Filed July 21, 1947. Granted Oct. 10, 1950.



Attachment for a cutting torch includes a torch-gripping clamp and a rigid shaft extending from it. A sun gear is rigidly fixed to the shaft. A planetary train of gears is arranged about the sun gear. One end of the train drives an inertia wheel. A support-contacting drive wheel has a central opening receiving the shaft for rotation of the drive wheel on the shaft. The drive wheel is the only support for the attachment. A gear box is fixed to and rotatable by the drive wheel. The gear box encloses the sun gear, gear train and inertia wheel, the inertia wheel and the gears of the train being journaled in the walls of the gear box. The drive wheel moves when the attachment is shifted so that bodily rotation of the inertia wheel and planetary gears around the sun gear is accomplished.

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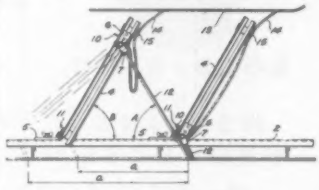
Automatic Arc Welder

2,536,999. ERNST SKYTTE, Copenhagen, Denmark. Assigned to American Relay-Welder Co., Newark, N. J. Filed Nov. 21, 1946. Granted Jan. 2, 1951.



Patent refers to an automatic arc welding machine that comprises a foot plate, a base rail along the foot plate and two guide rails adjustable along the base rail and adjustably inclined at an acute angle to the plane of the foot plate. Each guide rail has a longitudinal slideway. An electrode holder is mounted in a slide on the slideway. There are means removably securing the foot plate to the work so that the bases of electrodes in the electrode holders will rest in the line of welding. Electrodes are connected to the current supply and the work is connected to the other side of the supply. A device automatically shifts the first electrode at the end of its burning period in the direction of the following electrode until the arc of the first electrode is delivered to the following electrode.

* * *

Arc Welding Device

2,523,291. GILBERT GILLIVER, London. Assigned to International Standard Electric Corp., New York City. Filed Jan. 2, 1947. Granted Sept. 26, 1950.

Patent covers a fixture for electrically welding a bead tip to a workpiece. It includes a metal stand, a non-conducting top part having a recessed portion, fastened to the stand, a metallic spring forming a connection between the stand and the metal workpiece and conductors connecting the metal stand to a source of current.

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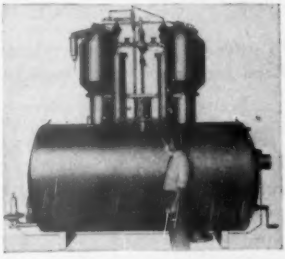

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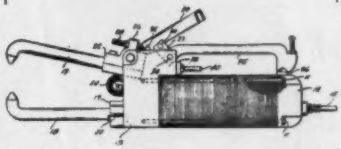
Portable Spot Welder

2,535,946. ALLAN C. MULDER, Appleton, Wis. Assigned to Miller Electric Mfg. Co., Appleton, Wis. Filed May 26, 1949. Granted Dec. 26, 1950.

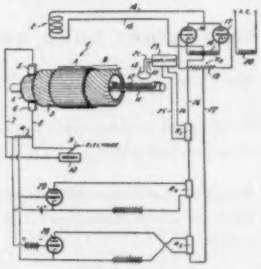


Patent pertains to a hand-operated light weight portable spot welder. It is essentially a transformer having a core and end caps, and has a pair of movable tongs carried by one of the end caps. This cap is connected to the transformer secondary. A carrying handle is fastened to one of the end caps. An operating handle overlies the carrying handle in hand-gripping relation. The latter is also secured to one of the end caps. A mechanical power multiplier is placed between the operating handle and the movable tongs so that the manual pressure applied by the operator to the handle is increased between the ends of the tongs.

* * *

Arc Welder

2,533,069. JOSEPH M. TYRNER, New York City. Assigned to Air Reduction Co., Inc., New York City. Filed April 30, 1946. Granted Dec. 5, 1950.



Patent covers a dynamo-electric machine for use in a welder. It comprises a main armature winding, a field winding for controlling the amount of current supplied by the machine and means for supplying excitation current to the field winding. There are means inductively related to the armature winding and operatively connected to the means for supplying excitation current to the field winding. This causes the excitation to change in inverse ratio to the armature current. The current supplied to the load is maintained substantially constant throughout a predetermined range of voltage supplied to the load. The means are inductively related to the armature winding which includes an auxiliary armature winding mounted on the armature for rotation therewith. It is responsive to the armature reaction flux of the machine.

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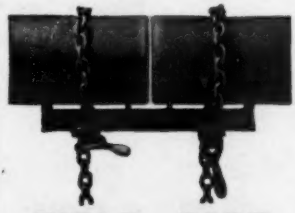

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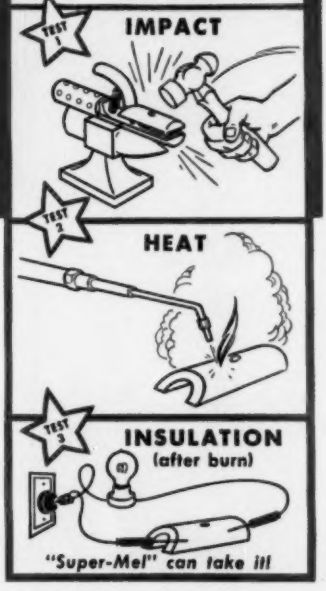

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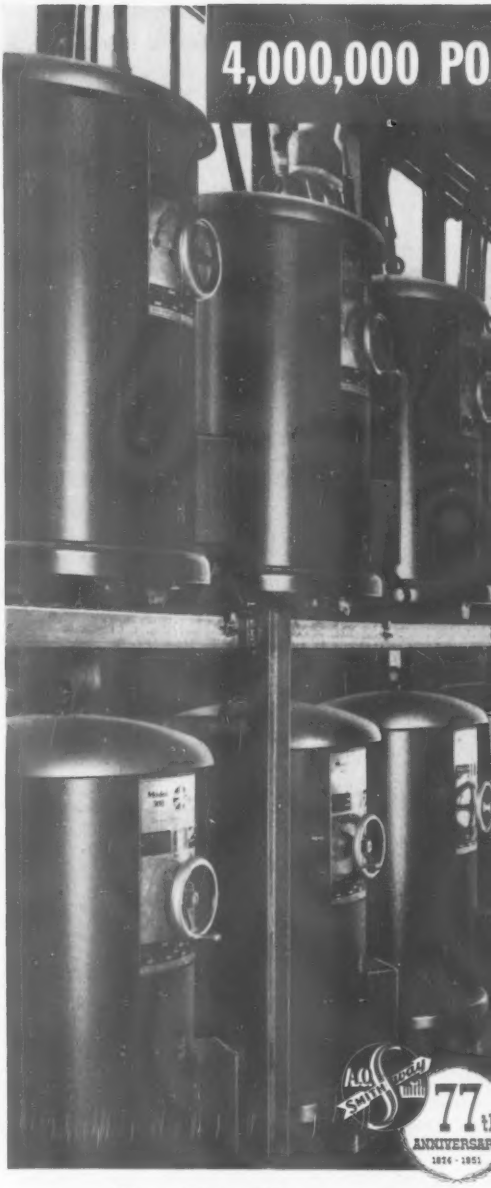

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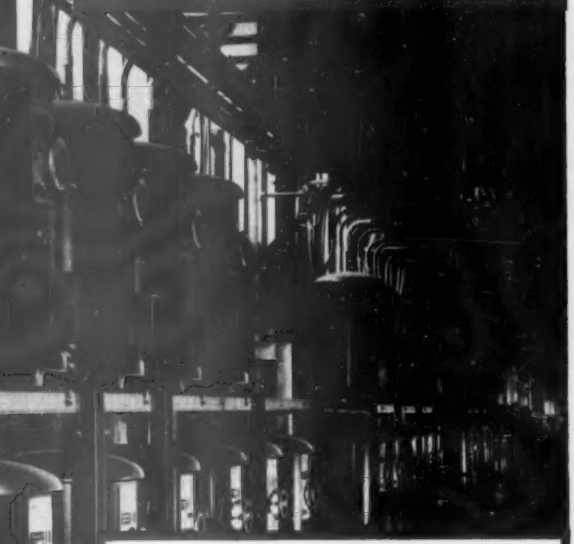

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